September 22, 2015

Mr. Philip Allen
Remedial Project Manager
USEPA
1445 Ross Ave.
Suite 1200
Dallas, TX 75202-2733

RE: Submittal of Response to EPA and TCEQ July 2015 Comments on Feasibility Study
Patrick Bayou Superfund Site – Deer Park, TX

Dear Mr. Allen:

On behalf of the Patrick Bayou Joint Defense Group (JDG) and pursuant to the Administrative Settlement Agreement and Order on Consent (AOC) for Remedial Investigation/Feasibility Study (RI/FS) at the Patrick Bayou Superfund Site in Deer Park, TX, we are pleased to submit the JDG's responses to EPA and TCEQ July 2015 comments on the Feasibility Study.

Should you have any questions please feel free to contact me at 919-539-1928 or at bobp@projectnavigator.com.

Sincerely,

s/R Piniewski

Robert Piniewski
Project Coordinator

cc: Satya Dwivedula - TCEQ
Patrick Bayou JDG

USEPA Comment	JDG Response
First, the JDG's Response to Comments has still not recognized the Patrick Bayou as a sustainable fishery as defined in the Texas Surface Water Quality Standards (TSWQS). This recognition is imperative to move this project forward. The EPA and the TCEQ have determined that Patrick Bayou meets the definition of a sustainable fishery; therefore, the corresponding water quality standards (for PCBs, mercury, and dioxin/furans as TCDD equivalents) must be considered in the remedial strategies.	The TCEQ has failed to provide a basis or sustaining facts for the presumption that Patrick Bayou is a sustainable fishery as defined by and in accordance with Texas Surface Water Quality Standards or law. Consequently, the Joint Defense Group (JDG) reiterates its position that Patrick Bayou does not meet the definition of a sustainable fishery as defined under 30 TAC Chapter 307. In fact, 30 TAC § 307.3(67) Appendix A **specifically exempts Patrick Bayou** from the list of water bodies that are deemed presumptive "sustainable fisheries" in the State of Texas. The JDG's detailed response to Texas Commission on Environmental Quality (TCEQ) comments on this issue is provided below. The Texas Commission on Environmental Quality's (TCEQ) comments suggest that the human health-based criterion for PCBs, dioxins and furans, and mercury are applicable to Patrick Bayou based on the general principle that all Texas bays, estuaries, and tidal rivers are considered to have sustainable fisheries. We disagree with this broad interpretation and, to clarify, present the following detailed rationale: TCEQ conducted its triennial review of the Texas Surface Water Quality Standards (TSWQS) found at 30 Texas Administrative Code (TAC) Chapter 307. TCEQ's proposed revisions to the TSWQS were published in the September 13, 2013, edition of the Texas Register.[4] The formal public comment period closed on October 24, 2013, and the final revisions were adopted by TCEQ in 2014. Included in the TCEQ's revisions are amendments to Table 2 in 30 TAC § 307.6(d)(1) (relating to Criteria in Water for Specific Toxic Materials; Human Health Protection) as they relate to Polychlorinated Biphenyls (CASRN 1336-36-3) (PCBs), dioxins and furans, and mercury.[6] It should be noted that TCEQ did not propose any amendments to Table 1 in § 307.6(c)(1) of the same regulations (relating to Criteria in Water for Specific Toxic Materials; Aquatic Life Protection) in relation to these chemicals.[7] Table 1 establishes the specific numerical criteria for protection of aquatic life from acute or chronic toxicity and applies to most water bodies in the State (e.g., chronic criterion of 0.03 µg/kg for PCBs in saltwater);[8] whereas Table 2 establishes the criteria for protection of human health and applies more narrowly to surface waters that are designated or used for public drinking water supplies, or which have sustainable fisheries.[9] The proposed amendments to Table 2 (i.e., human health protection) for PCBs, dioxins and furans, and mercury are the result of TCEQ's broader decision to no longer express the numerical criteria for several highly bioaccumulative pollutants as concentrations in fish tissue, but rather as water column concentrations.[10] The conversion from a fish tissue-based to water column-based concentration is accomplished by dividing the relevant fish tissue concentration by the relevant bioconcentration factor (BCF) which yields the water column concentration. The TSWQS currently identify three San Jacinto River Basin segments comprising the Houston Ship Channel: Segment No. 1005 (Houston Ship Channel / San Jacinto River Tidal); Segment No. 1006 (Houston Ship Channel Tidal); and Segment 1007 (Houston Ship Channel / Buffalo Bayou Tidal).[12] Patrick Bayou is physically located within Segment No. 1006. TCEQ is proposing a minor revision to Segment No. 1006, but it will simply add an inclusive reference to "Old River."[13] TCEQ's comments suggests that the human health-based criterion for PCBs, dioxins and furans and mercury are applicable to Patrick Bayou because 30 TAC § 307.6(d)(5)(D) provides that all bays, estuaries, and tidal rivers are considered to have sustainable fisheries. It should be noted, however, that § 307.6(d)(5) more specifically provides as follows: "The following waters are considered to have **sustainable fisheries**: (A) **all designated segments listed in Appendix A of §307.10 of this title, unless specifically exempted;** (B) perennial streams and rivers with a stream order of three or greater, as defined in §307.3 of this title (relating to Definitions and Abbreviations); (C) lakes and reservoirs greater than or equal to 150 acre-feet or 50 surface acres; (D) **all bays, estuaries, and tidal rivers; and** (E) **any other waters that potentially have sufficient fish production or fishing activity to create significant long-term human consumption of fish."** (Emphasis added). Similarly, 30 TAC § 307.3(67) defines the term "sustainable fisheries" as follows: "Descriptive of water bodies that **potentially have sufficient fish production or fishing activity to create significant long-term human consumption of fish**. Sustainable fisheries include perennial streams and rivers with a stream order of three or greater; lakes and reservoirs greater than or equal to 150 acre-feet or 50 surface acres; **all bays, estuaries, and tidal rivers.** Water bodies that are

USEPA Comment	JDG Response
	presumed to have sustainable fisheries include all designated segments listed in **Appendix A unless specifically exempted.**" (Emphasis added). Patrick Bayou lies within Segment 1006 of the Houston Ship Channel and is specifically exempted in Appendix A. It is important, therefore, to consider the extent to which Appendix A (relating to Site-specific Uses and Criteria for Classified Segments) contains any potentially applicable exemptions. Significantly, the Houston Ship Channel Segment Nos. 1006 and 1007 are the only classified segments for which the TSWQS do not designate any applicable recreational, aquatic life, or domestic water supply use, and for which navigation and industrial water supply are the only applicable designated uses. Additionally, the two classified segments contain a unique footnote which provides that "chronic numerical toxic criteria and chronic total toxicity requirements apply to Segments 1006 and 1007." Such site-specific uses and criteria are in direct conflict with the concept of a sustainable fishery, such that the numerical human health-based PCB criteria from Table 2 of 30 TAC § 307.6(d)(1) are not reasonably applicable.[14] The chronic aquatic life criteria for saltwater from Table 1 of 30 TAC § 307.6(c)(1) appears to remain applicable, however. Finally, it is noted that TCEQ is not proposing to amend the applicability provisions of the referenced numerical human health criteria other than simply expanding the existing phrase public drinking water supplies to specifically include all surface water bodies that are either identified as having a public drinking water supply use in Appendix A or identified as a sole-source drinking water supply in Appendix B.[15] Such revisions do not implicate Patrick Bayou or Segment No. 1006, which is not a public drinking water supply as discussed above. Footnotes: [1] The TSWQS currently identify three San Jacinto River Basin segments comprising the Houston Ship Channel: Segment No. 1005 (Houston Ship Channel / San Jacinto River Tidal); Segment No. 1006 (Houston Ship Channel Tidal); and Segment 1007 (Houston Ship Channel / Buffalo Bayou Tidal). See 30 TAC § 307.10(3) (relating to Appendix C - Segment Descriptions). [2] TCEQ Interoffice Memorandum from Technical Program Support Team, Division Support Section, Remediation Division, to Superfund Section, Remediation Division, dated October 10, 2013, regarding Patrick Bayou Remedial Investigation Report, prepared for Patrick Bayou Joint Defense Group by Anchor QEA, LLC. [3] Ibid, at General Comment No. 2, pp. 1 – 2. [4] http://www.sos.state.tx.us/texreg/archive/September132013/Proposed%20Rules/30.ENVIRONMENTAL %20QUALITY.html#74 [5] http://www.tceq.texas.gov/assets/public/waterquality/standards/tswqs_2014/TimelineAdoption.pdf [6] http://www.sos.state.tx.us/texreg/archive/September132013/tables-and-graphics/201303620-2.pdf [7] http://www.sos.state.tx.us/texreg/archive/September132013/tables-and-graphics/201303620-1.pdf [8] See 30 TAC § 307.6(c) (relating to Toxic Materials; Specific Numerical Aquatic Life Criteria). [9] See 30 TAC § 307.6(d) (relating to Toxic Materials; Specific Numerical Human Health Criteria). [10] See 30 TAC § 307.6(c)(10) and associated preamble discussion ("**human health criteria for 4,4'-DDD**, 4,4'-DDE, 4,4'-DDT, dioxins/furans, mercury, and <u>polychlorinated biphenyl</u>s, which were previously expressed as fish tissue- based concentrations, <u>are revised to water column-based concentrations"</u>). (Emphasis added). [11] See **Current footnote "+" for PCBs** which provides: **"An assumed BCF of 3.12E4 is used to translate the tissue-** based criterion to a water column criterion for the purposes of evaluating TPDES permittees. BCF value taken from Ambient Water Quality Criteria for Polychlorinated Biphenyls; October 1980; EPA 440/5-80-0**68.**" [12] 30 TAC § 307.10(3) (relating to Appendix C - Segment Descriptions). [13] **The revised description of Segment No. 1006 will provide as follows: "Houston Ship Channel Tidal** - from the confluence with the San Jacinto River in Harris County to a point immediately upstream of Greens Bayou in Harris County, including tidal portions of tributaries and <u>Old River</u>." **(Emphasis added).** [14] Additionally, under the legal doctrine of lex specialis derogat legi generali, the regulatory provision governing a specific subject matter (i.e., Houston Ship Channel aquatic use designation) should supersede the lesser specific general provision (i.e., broad aquatic use designation for bays, estuaries, and tidal rivers across the state generally). [15] See proposed 30 TAC § 307.6(d)(2)(A) (i.e., implicating only Column A in Table 2 relating to surface waters that are designated or used for public drinking water supplies) **which provides:** "These criteria apply to surface waters that are designated or used for public drinking water supplies, <u>including all water bodies identified as having a public drinking water supply use in Appendix A of this chapter or as a sole-source surface drinking water supply in Appendix B of this chapter.</u>"
Second, the probable effects level quotient (PEL-Q) issue has not been resolved. While we prefer a target PEL-Q value of 3.07, we are willing to consider the compromise PEL-Q value of 4.47, depending on our evaluation of the additional information requested below.	As previously documented, the probable effects level quotient (PEL-Q) value of 3.07 is not supported by the data or analysis presented in the U.S. Environmental Protection Agency (USEPA)-approved Baseline Ecological Risk Assessment (BERA). TCEQ's comments on the Draft Feasibility Study (FS) Report dated December 19, 2014 states a preference for the sediment preliminary remediation goal (PRG) to be set at a mean PEL-Q of 3.07 to represent the lowest mean PEL-Q for any station

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	TCEQ determined[1] to represent a probable risk to the benthic community. However, the **TCEQ analysis incorrectly classified Station 5, which had a mean PEL-Q of 3.07, as probable risk as compared to the correct classification of Station 5 as indeterminate risk** based on the agreed upon weight-of-evidence framework in the BERA. Thus, the lowest mean PEL-Q representing probable risk based on TCEQ's analysis would be 4.47 (Station Q), the same value put forward in the JDG's initial response to comments (March 11, 2015) on the Draft FS Report. As such, a mean PEL-Q of 3.07 would not represent probable risks to the benthic community based on the analysis in the USEPA-approved BERA or the analysis presented by TCEQ and is, therefore, not a relevant sediment PRG for the FS.
We request that the JDG provide the following information for our review: Revise the sediment management areas to ensure compliance with the sustainable fishery water quality standards (for water) or background concentrations (if background is higher) for mercury, PCBs, and dioxin/furans.	As detailed above in response to TCEQ's first comment, the JDG reiterates its position that Patrick Bayou does not meet the definition of a sustainable fishery and that therefore the human health water quality standard (WQS) is not an Applicable or Relevant and Appropriate Requirement. Nonetheless, with regard to polychlorinated biphenyls (PCBs), results of the modeling indicate that the concentration of PCBs in Patrick Bayou at its confluence with the Houston Ship Channel (HSC) will reach the range of background values observed in the HSC within 10–15 years (see attached Figure 4-2 of the Draft FS Report) under the preferred alternative (Alternative 3). Preliminary evaluations indicate that tidal mixing between Patrick Bayou and the HSC does not extend more than 1–2 miles upstream of their confluence. Thus, the concentration of PCBs in the HSC upstream of Patrick Bayou measured as part of the PCB total maximum daily load (TMDL) studies can be used to assess background conditions within Patrick Bayou due to tidal exchange. Summing the dissolved and particulate fractions measured in the TMDL study to calculate total PCBs in surface water from locations in the HSC greater than 5 miles upstream of Patrick Bayou, the average concentration in surface water is 3.0 nanograms per liter (ng/L), with a range of 1.3 to 7.7 (Exhibit 1). Using the 95% upper tolerance limit (95UTL) with 90% coverage as a typical estimate of a background threshold value, the result is 6.5 ng/L. Thus, it is expected that the preferred alternative (Alternative 3), in addition to meeting the aquatic life WQS, will lower water column concentrations in Patrick Bayou at its mouth to the range of upstream HSC background levels within 10–15 years.[2] Mercury was not identified as a chemical of potential concern in the USEPA-approved Baseline Human Health Risk Assessment (Anchor QEA 2012) for the fish or shellfish ingestion pathway.[3] The TCEQ Human Health Protection Water Quality Standard for mercury is based on a tissue criterion of 1 part per million (ppm) wet weight (WW) fish tissue.[4] Using the concentration of mercury in smaller forage fish collected during the BERA (Anchor QEA 2013a) in conjunction with literature-based biomagnification factors and conversion factors between whole body and filet tissue, it was estimated that the concentration of mercury in the fillet tissue of larger fish would not exceed the 1 ppm tissue criterion upon which the WQS is based. Specifically, multiplying the 95UTL of all fish collected during the BERA sampling event (0.092 ppm WW) by a predator-prey factor of 5.0 to account for the biomagnification of mercury from forage fish to larger piscivorous fish (USEPA 1997)[5] and applying a whole body to fillet conversion algorithm (Bevelhimer et al. 1997) yields an estimated mercury concentration in edible tissue of 0.7 ppm. Thus, it is unlikely that mercury in Patrick Bayou surface water is entering the aquatic food chain and bioaccumulating in the edible tissue of fish at concentrations that exceed the value upon which the human health WQS is based. This is consistent with the very low rates of mercury methylation observed in site sediments and porewater, which would limit the bioavailable fraction of mercury to surface water and the aquatic food chain. Thus, revision of sediment management areas to account for mercury is not required. With respect to dioxins/furans, as discussed in the remedial investigation and risk assessments, there are no site-related risks or significant site-related sources attributable to these chemicals. Nonetheless, as described below, the existing

[1] Based on the analysis presented in their May 15, 2013, letter on the revised BERA submitted by the JDG in March 2013 and subsequently approved as final by USEPA

[2] It should be noted that the model results are depicted as average annual, vertically and laterally integrated concentration values.

[3] As such, no fish or shellfish tissue was collected and analyzed for mercury as part of the human health tissue sampling and analysis effort for the remedial investigation.

[4] The 2014 TCEQ WQS for mercury is adopted from the previous USEPA-approved 2000 WQS, which is based on the U.S. Food and Drug Administration action level of 1 ppm in fish tissue.

[5] Use of predator-prey factor of 5.0 is likely conservative, as several species collected during the BERA were not forage fish but were smaller predatory fish (e.g., killifish).

<table>
<tr><th>USEPA Comment</th><th>JDG Response</th></tr>
<tr><td></td><td>surface water data within the site, when evaluated together with those from the larger HSC, indicate that surface water concentrations of dioxins/furans within Patrick Bayou are a reflection of regional contributions from the adjacent HSC (driven by tidal exchange between the two waterbodies) and thus would not be affected to a meaningful extent by any sediment management activities conducted within Patrick Bayou. Therefore, the sediment management areas do not require further revision to account for these chemicals.

Exhibit 2 shows a spatial profile of water column dioxins/furans concentrations on a toxic equivalency (TEQ_{DF})[6] basis in the HSC. This figure illustrates that water column TEQ_{DF} concentrations collected within the HSC as part of the TCEQ TMDL Study exceed the WQS[7] of 0.078 picograms per liter throughout the entire HSC, with generally higher concentrations occurring within the region extending approximately 6 miles upstream of Patrick Bayou as well as the areas adjacent to and downstream of the site. Exhibit 2 also shows calculated TEQ_{DF} concentrations for the water column data collected from within Patrick Bayou and one location within HSC as part of the Patrick Bayou Remedial Investigation (RI) (Anchor QEA 2013b). The TEQ_{DF} calculations for the Patrick Bayou RI water column samples are confounded by relatively high detection limits for dioxins/furans that resulted in a large number of non-detects. Nonetheless, the TEQ_{DF} concentrations in the Patrick Bayou RI water column data (including the one HSC location) are very similar to the regional concentrations observed in the adjacent HSC from the TMDL Study. Furthermore, the TEQ_{DF} concentrations observed within the Patrick Bayou RI surface water dataset show that the higher detectable concentrations all occurred at the HSC location or at the locations within Patrick Bayou closest to the HSC, with much lower concentrations (and fewer detections) at the locations further upstream—this pattern is consistent with dioxins/furans within Patrick Bayou surface water being attributable to tidal exchange from the HSC.</td></tr>
<tr><td>Revise the sediment management areas to meet the target sediment PEL-Q intended to be protective of the benthic invertebrate pathway.</td><td>While the JDG does not agree with the use of a PEL-Q of 3.07 for reasons stated above, as requested the sediment management areas (SMAs) have been redrawn in the attached figures (Exhibits 3 and 4) to reflect a target mean PEL-Q of 3.07 and 4.47, respectively.[8] Figure 4-1 from the Draft FS Report depicting these areas based on a mean PEL-Q of 7.55 is included for reference as well.</td></tr>
<tr><td>Provide sediment maps depicting the remedial foot print for proposed Remedial Alternatives 3 and 4 in the draft FS, to meet each of the PEL-Q values of 3.07, 4.47, and 7.56, in combination with the water quality standards for PCBs, mercury, and dioxin/furans as TCDD equivalents.</td><td>While the JDG does not agree with the use of a PEL-Q of 3.07 for reasons stated above, sediment maps depicting proposed Alternatives 3 and 4 in the Draft FS Report using a mean PEL-Q of 3.07 and 4.47 are attached as Exhibits 5 through 8.[9] Figures 4-4 and 4-6 from the Draft FS Report are included for comparisons based on the mean PEL-Q of 7.56.</td></tr>
<tr><td>Provide sediment management areas (acreages) for proposed Remedial Alternatives 3 and 4 in the draft FS, to meet each of the PEL-Q values of 3.07, 4.47, and 7.56, in combination with the water quality standard s for PCBs, mercury, and dioxin/furans as TCDD equivalents.</td><td>Notwithstanding the application of the human health Texas Surface Water Quality Standard based on the definition of sustainable fishery or the target sediment PEL-Q of 3.07, neither of which the JDG agrees with for the reasons described in the above responses, acreages for the monitored natural recovery (MNR) area and SMA are as follows:

<table>
<tr><th rowspan="2">(Acres)</th><th colspan="2">Mean PEL-Q = 7.76</th><th colspan="2">Mean PEL-Q = 4.47</th><th colspan="2">Mean PEL-Q = 3.07</th></tr>
<tr><th>Alternative 3</th><th>Alternative 4</th><th>Alternative 3</th><th>Alternative 4</th><th>Alternative 3</th><th>Alternative 4</th></tr>
<tr><td>MNR</td><td>16.9</td><td>16.9</td><td>25.9</td><td>24.1</td><td>27.5</td><td>23.2</td></tr>
<tr><td>ACBM with RCM Treatment</td><td>1.3</td><td>1.3</td><td>1.3</td><td>1.3</td><td>1.3</td><td>1.3</td></tr>
<tr><td>AC Treatment</td><td>4.3</td><td>--</td><td>6.6</td><td>--</td><td>11.1</td><td>--</td></tr>
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</table>
Notes:
-- not applicable</td></tr>
</table>

[6] The TEQ shown on Figure 1 was calculated using dioxin/furan toxic equivalency factors (TEFs) summarized in Table 2 of the TCEQ Chapter 307 - Texas Surface Water Quality Standards, Rule Project No. 2012-001-307-OW, and does not include contributions from dioxin-like PCB congeners. Non-detect dioxin/furan congeners were set to zero for this calculation.

[7] It should be noted that the WQS for TEQ reflects contributions from dioxin and furan congeners as well as four dioxin-like PCB congeners, which were not included in the calculation of TEQ in the HSC water samples; this illustrates that dioxin/furan TEQ alone exceeds the WQS throughout most of the HSC.

[8] Note that, consistent with the above response regarding the applicability of the mean PEL-Q of 3.07 as a sediment target value, Exhibit 3 is provided for comparison only and is not considered a relevant sediment target value.

[9] Note that, consistent with the above response regarding the applicability of the mean PEL-Q of 3.07 as a sediment target value, Exhibits 5 and 6 are provided for comparison only.

USEPA Comment	JDG Response
	AC – activated carbon ACBM – articulated concrete block mat PEL-Q – probable effects level quotient RCM – reactive core mat
Propose an approach to determine background concentrations for mercury, PCBs, and dioxin/furans (as TCDD equivalents) in the water column.	Based on the analysis presented previously and herein, there are adequate data to demonstrate that PCBs will meet the aquatic life WQS and fall within the range of upstream HSC background within 10 to 15 years. Although there are no existing background mercury data in the HSC to perform any meaningful analysis, estimates of edible tissue concentrations using smaller forage fish collected in Patrick Bayou indicate the U.S. Food and Drug Administration action level, upon which the human health WQS is based, is not exceeded, notwithstanding the exclusion of Patrick Bayou as a sustainable fishery. Finally, dioxin/furan concentrations are comparable to the range of upstream HSC concentrations and, based on the distribution in Patrick Bayou, indicate that the primary source of dioxins/furans in the water column, particularly in the downstream reaches, is most likely the HSC itself. Thus, there is no reason or need for the collection of background data for these constituents, particularly for dioxin/furans and mercury, which were not identified as contaminants of concern for the site.

Acronyms and Definitions

AC – activated carbon
BCF – bioconcentration factor
BERA – Baseline Ecological Risk Assessment
FS – Feasibility Study
HSC – Houston Ship Channel
JDG – Joint Defense Group
MNR – monitored natural recovery
ng/L – nanograms per liter
PCB – polychlorinated biphenyl
PEL-Q – probable effects level quotient
ppm – part per million
PRG – preliminary remediation goal
RI – remedial investigation
SMA – sediment management areas
TCEQ – Texas Commission on Environmental Quality
TEQ_{DF} – toxic equivalency
TMDL – total maximum daily load
USEPA – United States Environmental Protection Agency
UTL – upper tolerance limit
WQS – water quality standard

WW – wet weight

References

Anchor QEA, LLC (Anchor QEA), 2012. *Baseline Human Health Risk Assessment Report*. Patrick Bayou Superfund Site. Deer Park, Texas. Final.

Anchor QEA, 2013a. *Baseline Ecological Risk Assessment Report*. Patrick Bayou Superfund Site. Deer Park, Texas. Final.

Anchor QEA, 2013b. *Remedial Investigation Report*. Patrick Bayou Superfund Site. Deer Park, Texas. Final.

Bevelhimer, M.S., J.J. Beauchamp, B.E. Sample, and G.R. Southworth, 1997. *Estimation of Whole-Fish Contaminant Concentrations from Fish Fillet Data*. ES/ER/TM-202. Prepared by the Risk Assessment Program. Oak Ridge National Laboratory.

USEPA (U.S. Environmental Protection Agency), 1997. *Mercury Study Report to Congress. Volume III: Fate and Transport of Mercury in the Environment*. EPA-452/R-97-005.

SUPPORTING INFORMATION

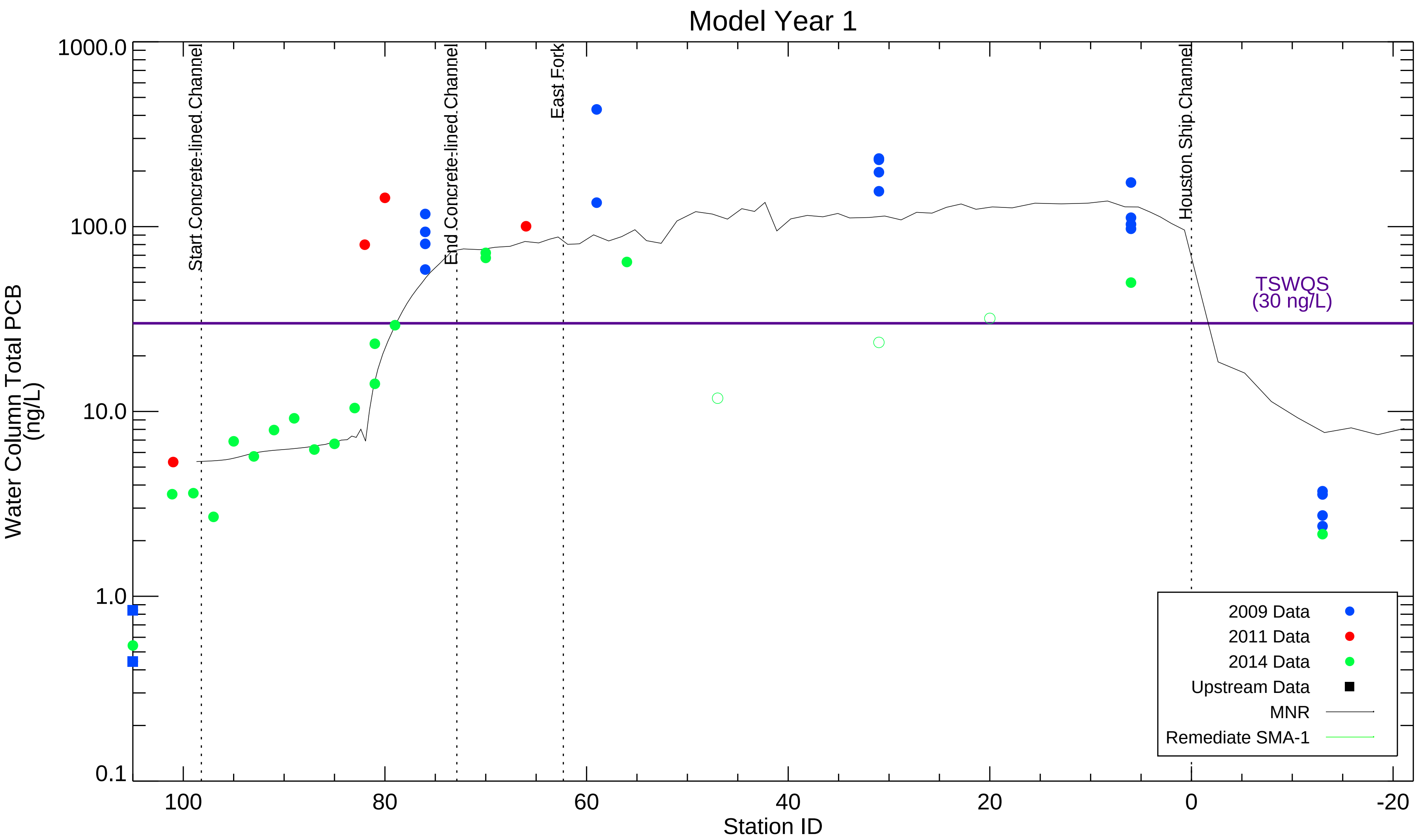

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Figure 4-2a

Spatial Profile of Model-predicted Water Column Total PCB Concentration for MNR and Remediation of SMA-1

Draft Feasibility Study Report

Patrick Bayou Superfund Site

Open circles represent samples having potential incomplete lateral mixing.

ANCHOR QEA

LHB - \\helios\aq\D_Drive\Projects\Patrick_Bayou_Joint_Defense_Group\Patrick_Bayou(040284-01)\MODEL\EFDC\Post_process\Water_Column\plot\plot_all\PB_WC_data_spatial_depth_avg_longterm_oplot_Cal_Proj.pro Thu Sep 04 15:49:37 2014

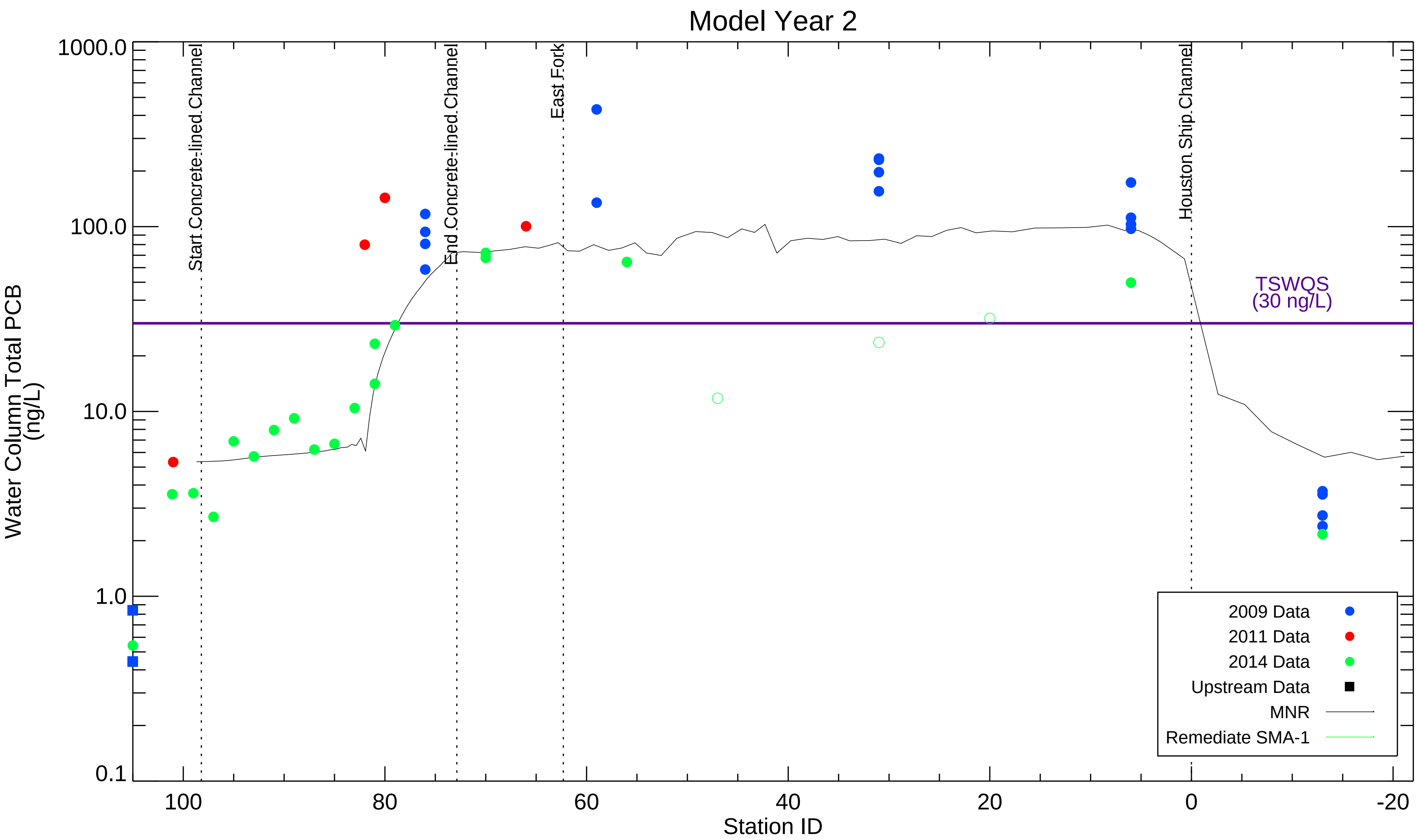

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Figure 4-2b

Spatial Profile of Model-predicted Water Column Total PCB Concentration for MNR and Remediation of SMA-1

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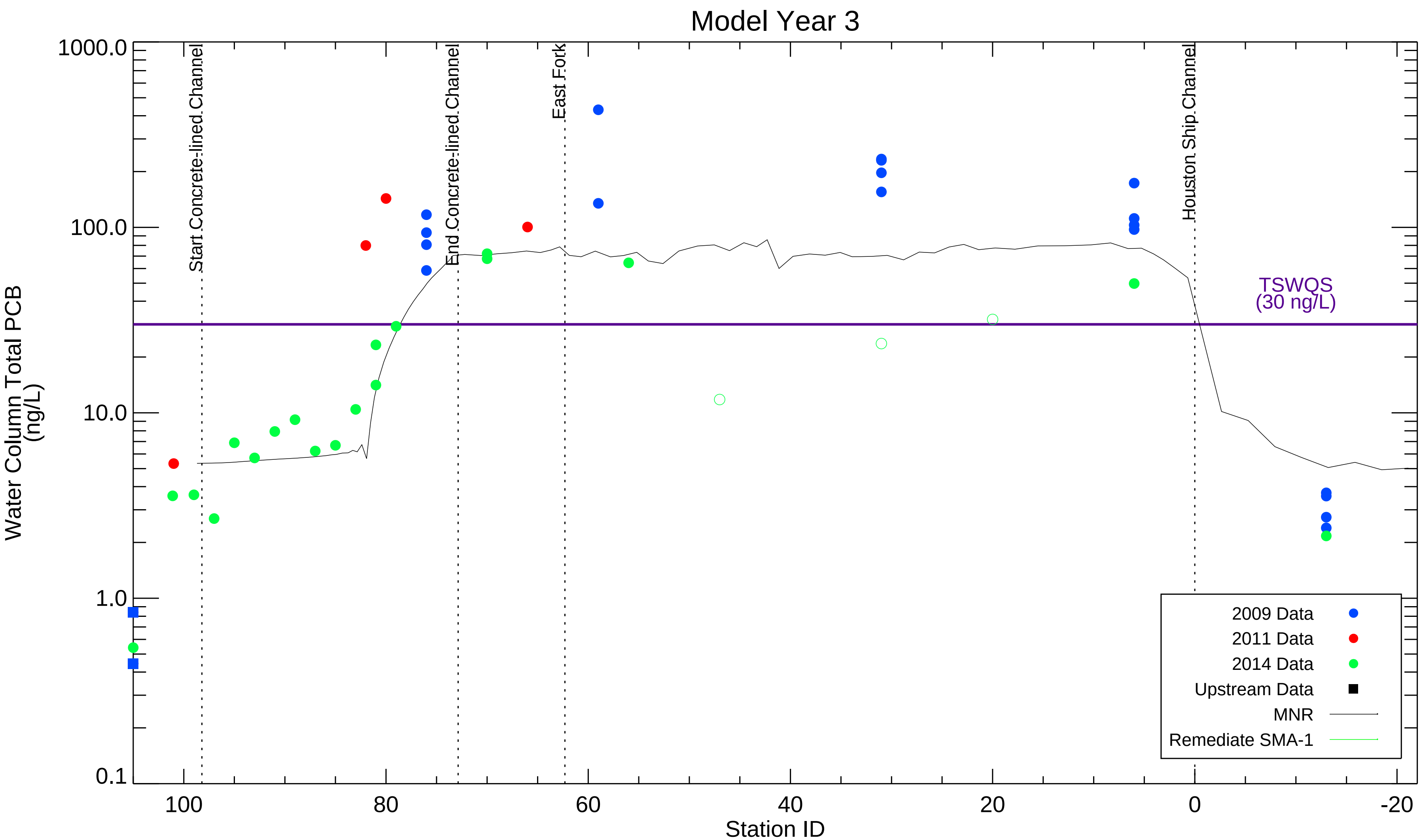
Patrick Bayou Superfund Site

Open circles represent samples having potential incomplete lateral mixing.

LHB - \\helios\aq\D_Drive\Projects\Patrick_Bayou_Joint_Defense_Group\Patrick_Bayou(040284-01)\MODEL\EFDC\Post_process\Water_Column\plot\plot_all\PB_WC_data_spatial_depth_avg_longterm_oplot_Cal_Proj.pro Thu Sep 04 15:49:49 2014



Model Run: PB_PROJ1_PCB-TOT_1406-32, PB_PROJ2_PCB-TOT_1406-34

Figure 4-2c

Spatial Profile of Model-predicted Water Column Total PCB Concentration for MNR and Remediation of SMA-1

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Patrick Bayou Superfund Site

Open circles represent samples having potential incomplete lateral mixing.

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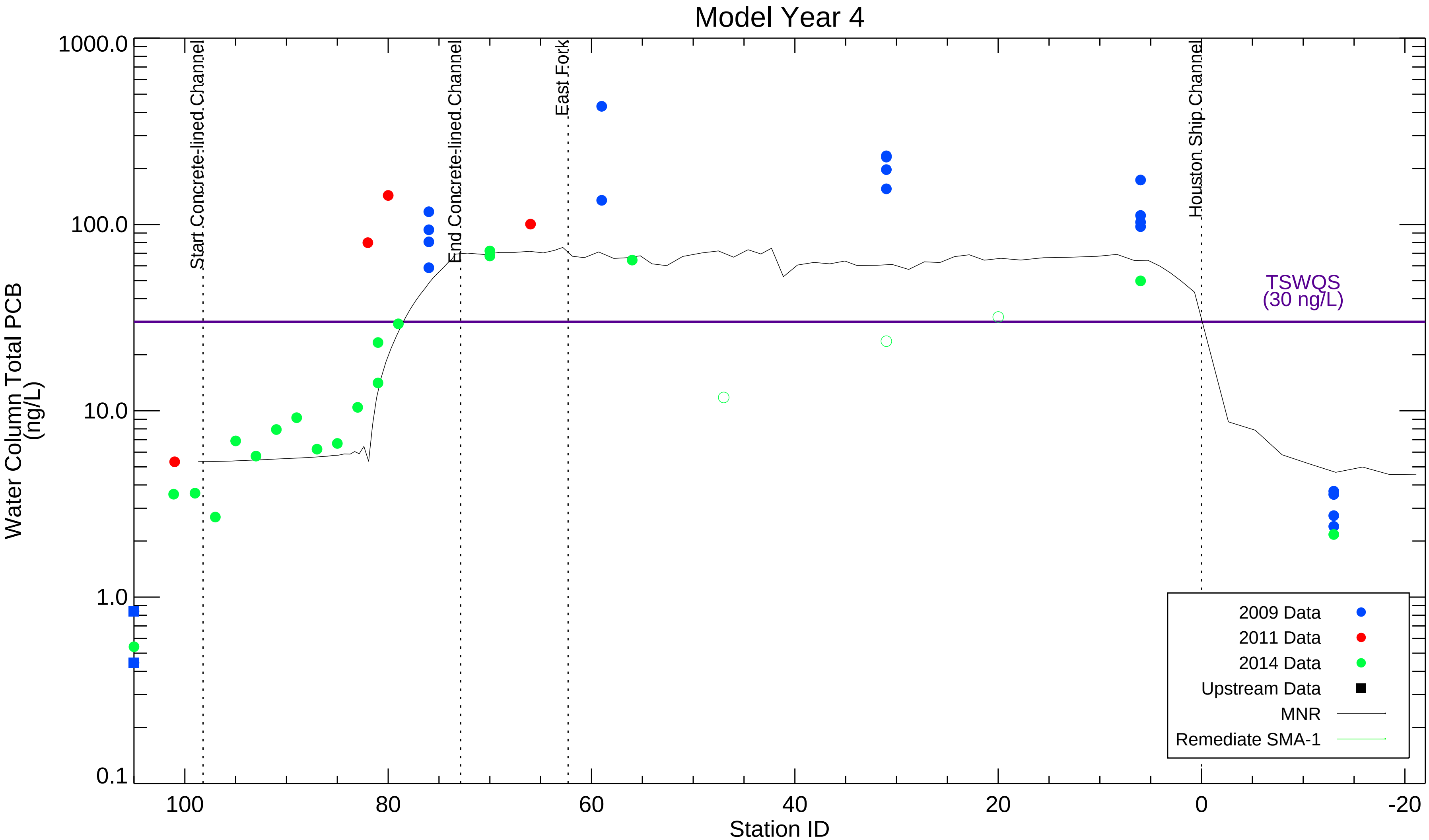

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Figure 4-2d

Spatial Profile of Model-predicted Water Column Total PCB Concentration for MNR and Remediation of SMA-1
Draft Feasibility Study Report
Patrick Bayou Superfund Site

Open circles represent samples having potential incomplete lateral mixing.

LHB - \\helios\aq\D_Drive\Projects\Patrick_Bayou_Joint_Defense_Group\Patrick_Bayou(040284-01)\MODEL\EFDC\Post_process\Water_Column\plot\plot_all\PB_WC_data_spatial_depth_avg_longterm_oplot_Cal_Proj.pro Thu Sep 04 15:50:12 2014

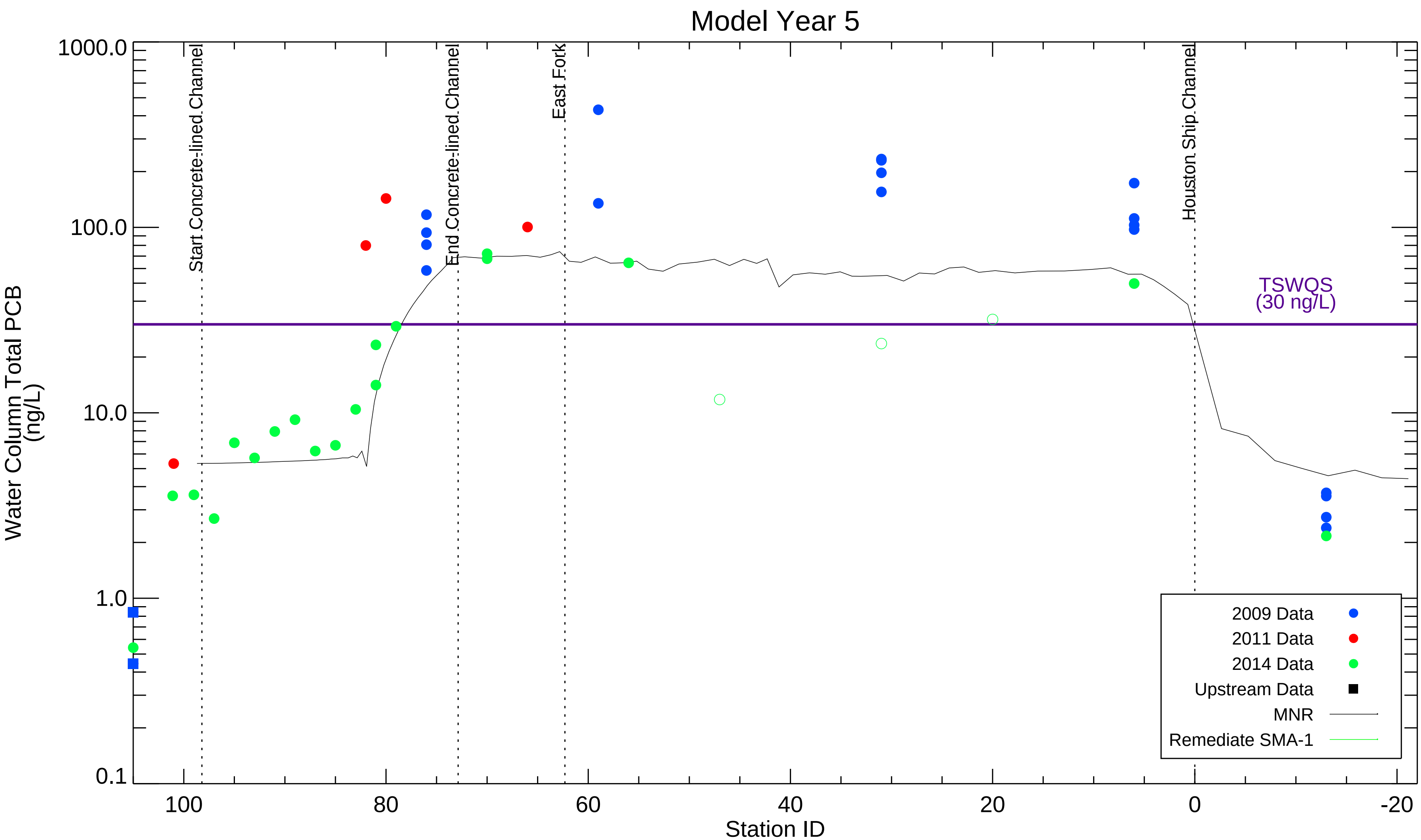

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Figure 4-2e

Spatial Profile of Model-predicted Water Column Total PCB Concentration for MNR and Remediation of SMA-1

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Patrick Bayou Superfund Site

Open circles represent samples having potential incomplete lateral mixing.

LHB - \\helios\aq\D_Drive\Projects\Patrick_Bayou_Joint_Defense_Group\Patrick_Bayou(040284-01)\MODEL\EFDC\Post_process\Water_Column\plot\plot_all\PB_WC_data_spatial_depth_avg_longterm_oplot_Cal_Proj.pro Thu Sep 04 15:50:24 2014

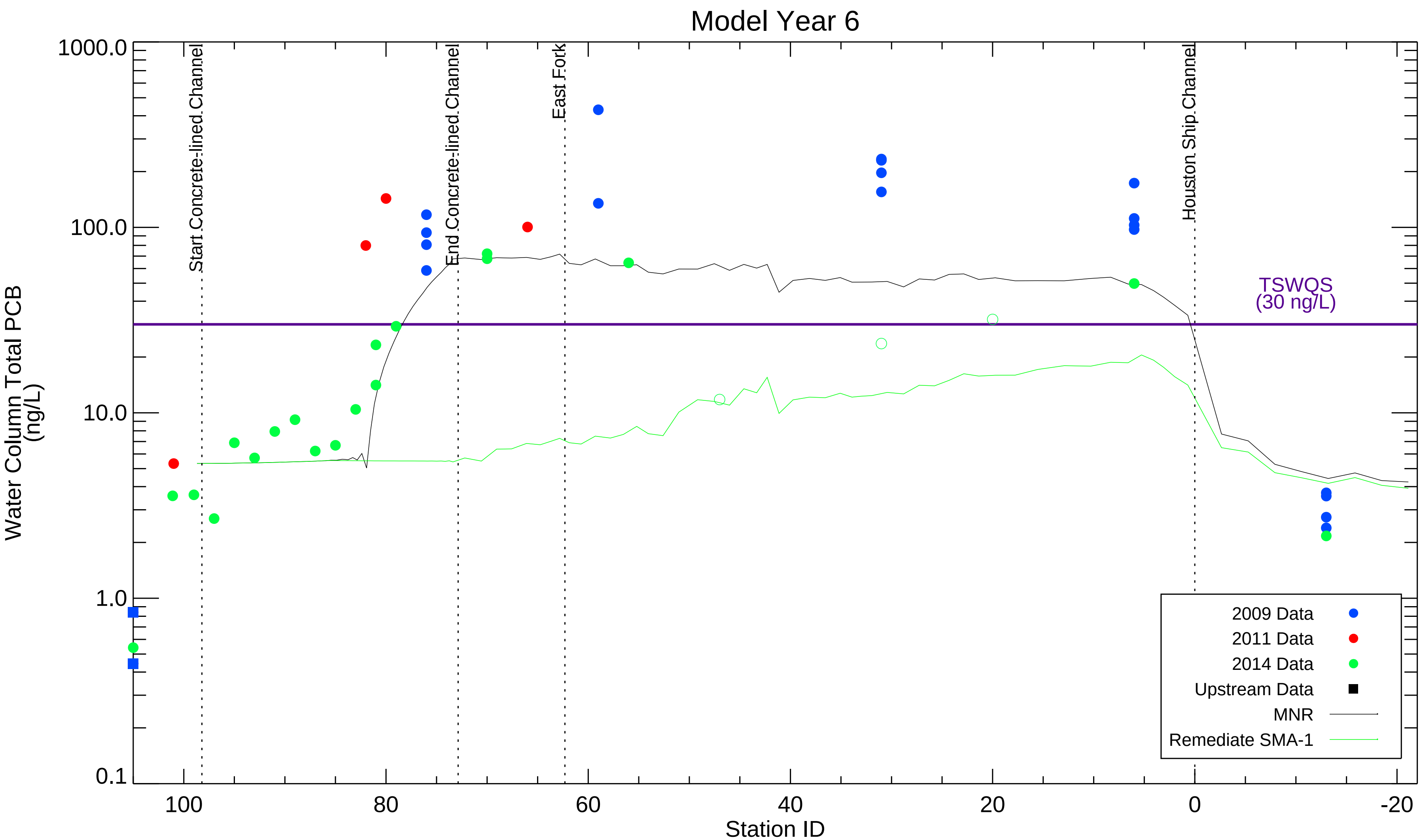

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Figure 4-2f

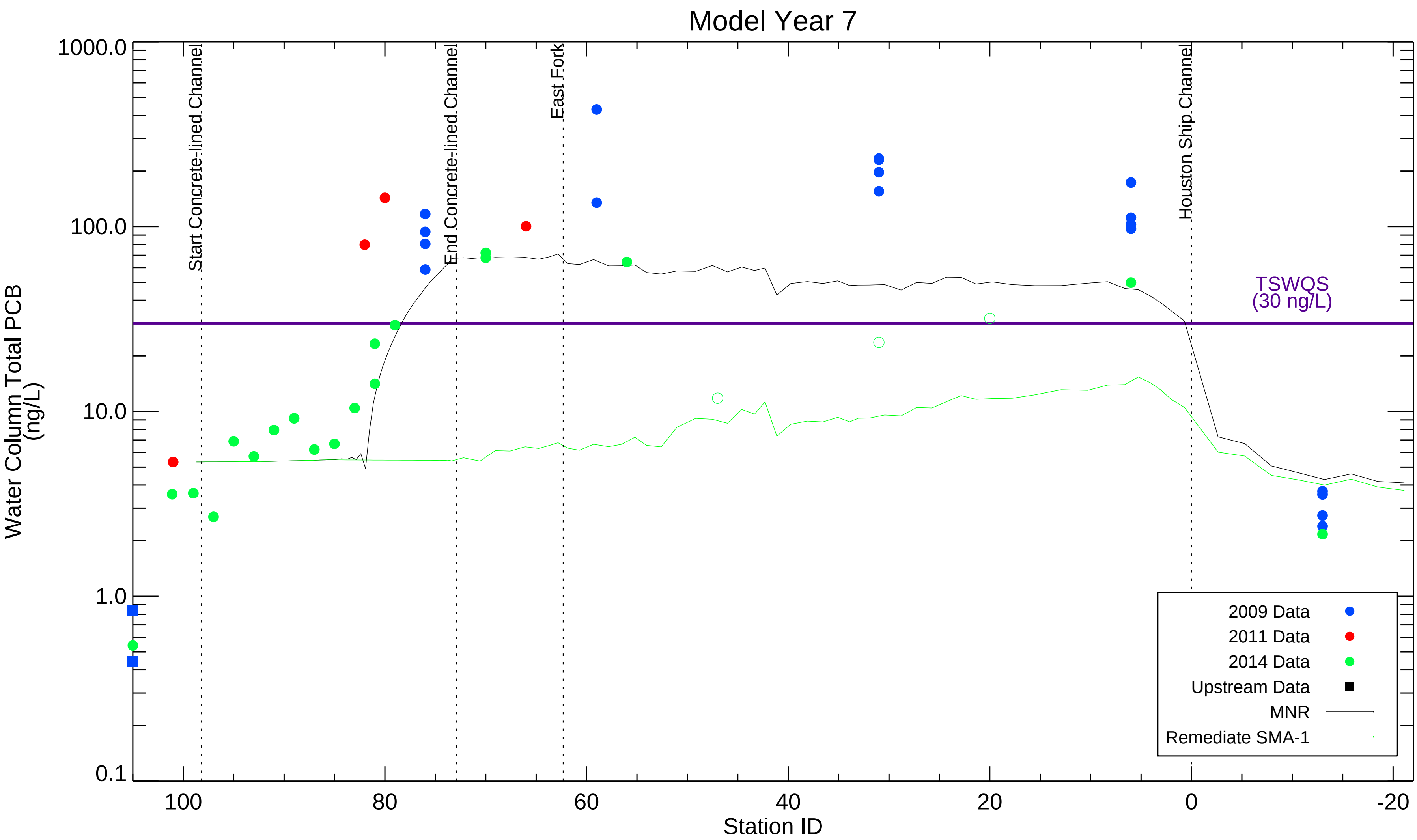
Spatial Profile of Model-predicted Water Column Total PCB Concentration for MNR and Remediation of SMA-1

Draft Feasibility Study Report

Patrick Bayou Superfund Site

Open circles represent samples having potential incomplete lateral mixing.

LHB - \\helios\aq\D_Drive\Projects\Patrick_Bayou_Joint_Defense_Group\Patrick_Bayou(040284-01)\MODEL\EFDC\Post_process\Water_Column\plot\plot_all\PB_WC_data_spatial_depth_avg_longterm_oplot_Cal_Proj.pro Thu Sep 04 15:50:46 2014



Model Run: PB_PROJ1_PCB-TOT_1406-32, PB_PROJ2_PCB-TOT_1406-34

Figure 4-2g

Spatial Profile of Model-predicted Water Column Total PCB Concentration for MNR and Remediation of SMA-1
Draft Feasibility Study Report
Patrick Bayou Superfund Site

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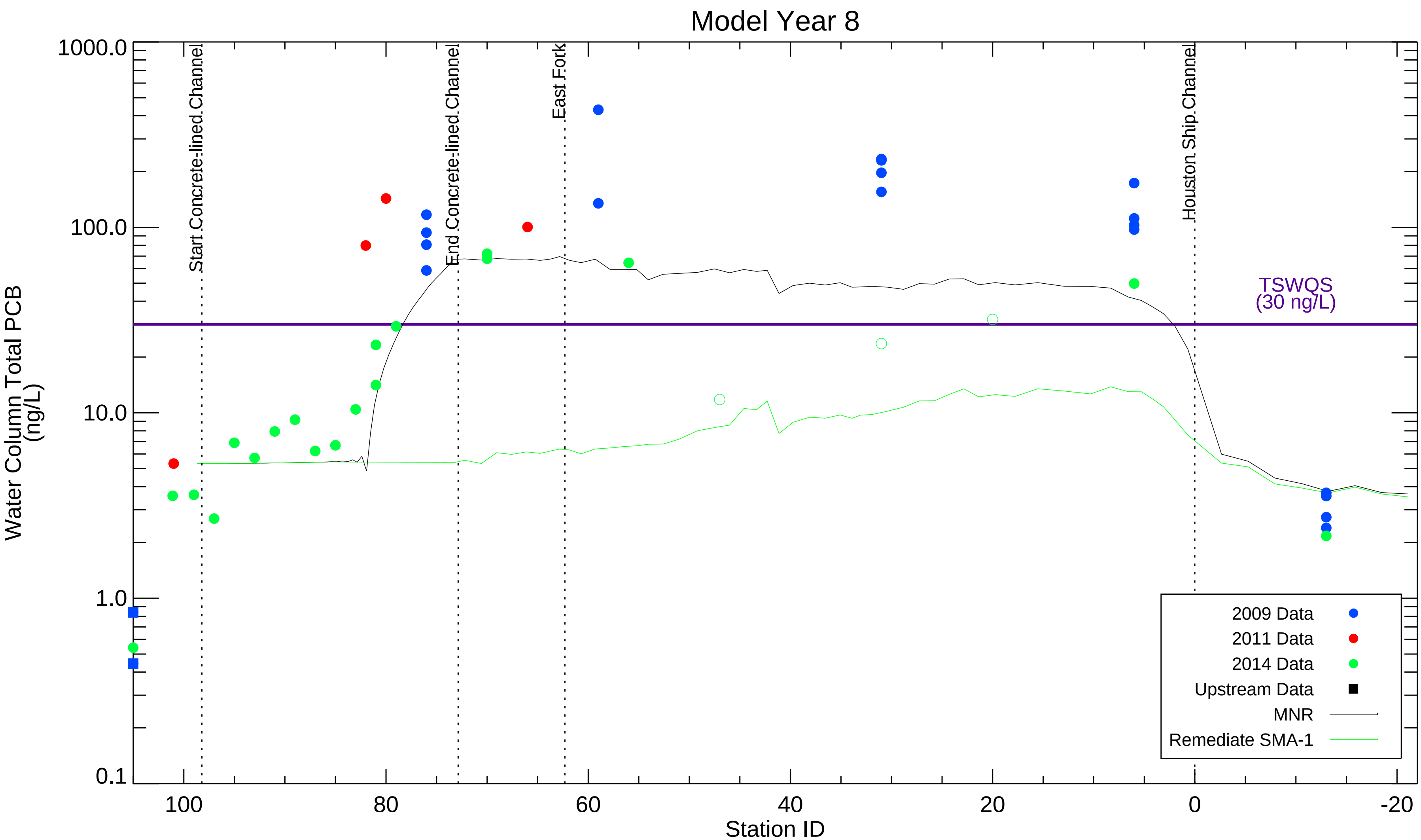
LHB - \\helios\aq\D_Drive\Projects\Patrick_Bayou_Joint_Defense_Group\Patrick_Bayou(040284-01)\MODEL\EFDC\Post_process\Water_Column\plot\plot_all\PB_WC_data_spatial_depth_avg_longterm_oplot_Cal_Proj.pro Thu Sep 04 15:51:09 2014



Model Run: PB_PROJ1_PCB-TOT_1406-32, PB_PROJ2_PCB-TOT_1406-34

Figure 4-2h

Spatial Profile of Model-predicted Water Column Total PCB Concentration for MNR and Remediation of SMA-1
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Patrick Bayou Superfund Site

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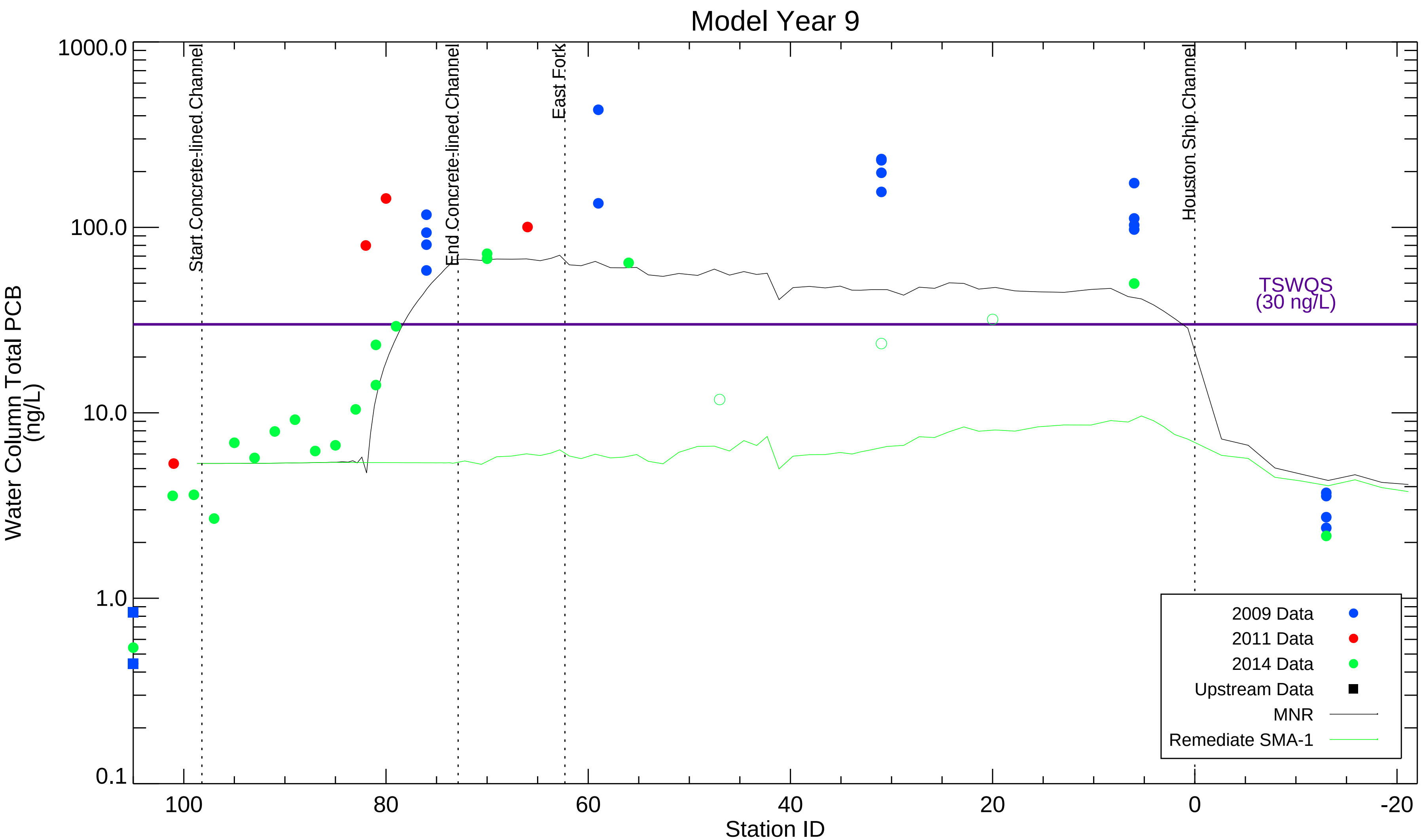
LHB - \\helios\aq\D_Drive\Projects\Patrick_Bayou_Joint_Defense_Group\Patrick_Bayou(040284-01)\MODEL\EFDC\Post_process\Water_Column\plot\plot_all\PB_WC_data_spatial_depth_avg_longterm_oplot_Cal_Proj.pro Thu Sep 04 15:51:32 2014



Model Run: PB_PROJ1_PCB-TOT_1406-32, PB_PROJ2_PCB-TOT_1406-34

Figure 4-2i

Spatial Profile of Model-predicted Water Column Total PCB Concentration for MNR and Remediation of SMA-1

Draft Feasibility Study Report

Patrick Bayou Superfund Site

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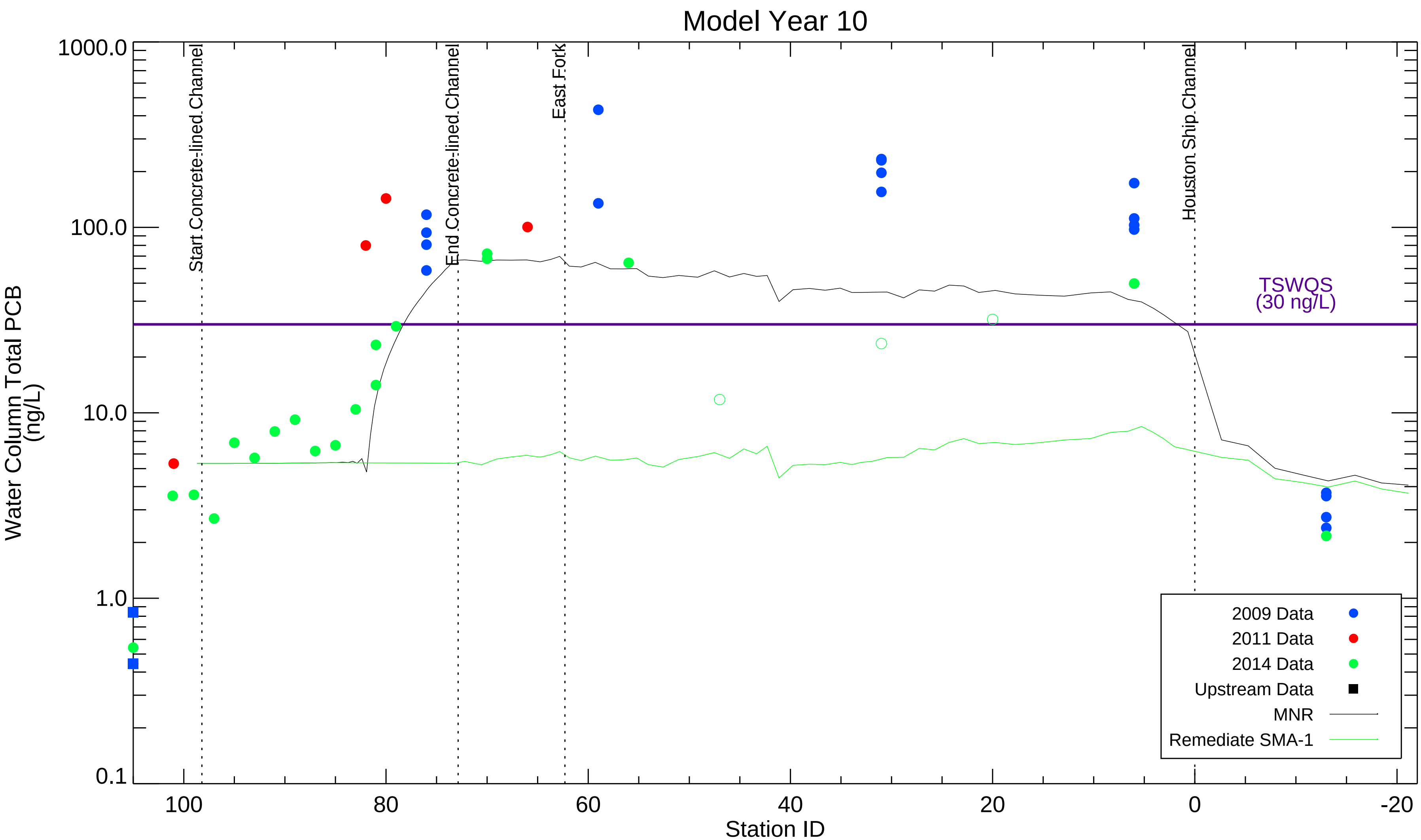

Model Run: PB_PROJ1_PCB-TOT_1406-32, PB_PROJ2_PCB-TOT_1406-34

Figure 4-2j

Spatial Profile of Model-predicted Water Column Total PCB Concentration for MNR and Remediation of SMA-1

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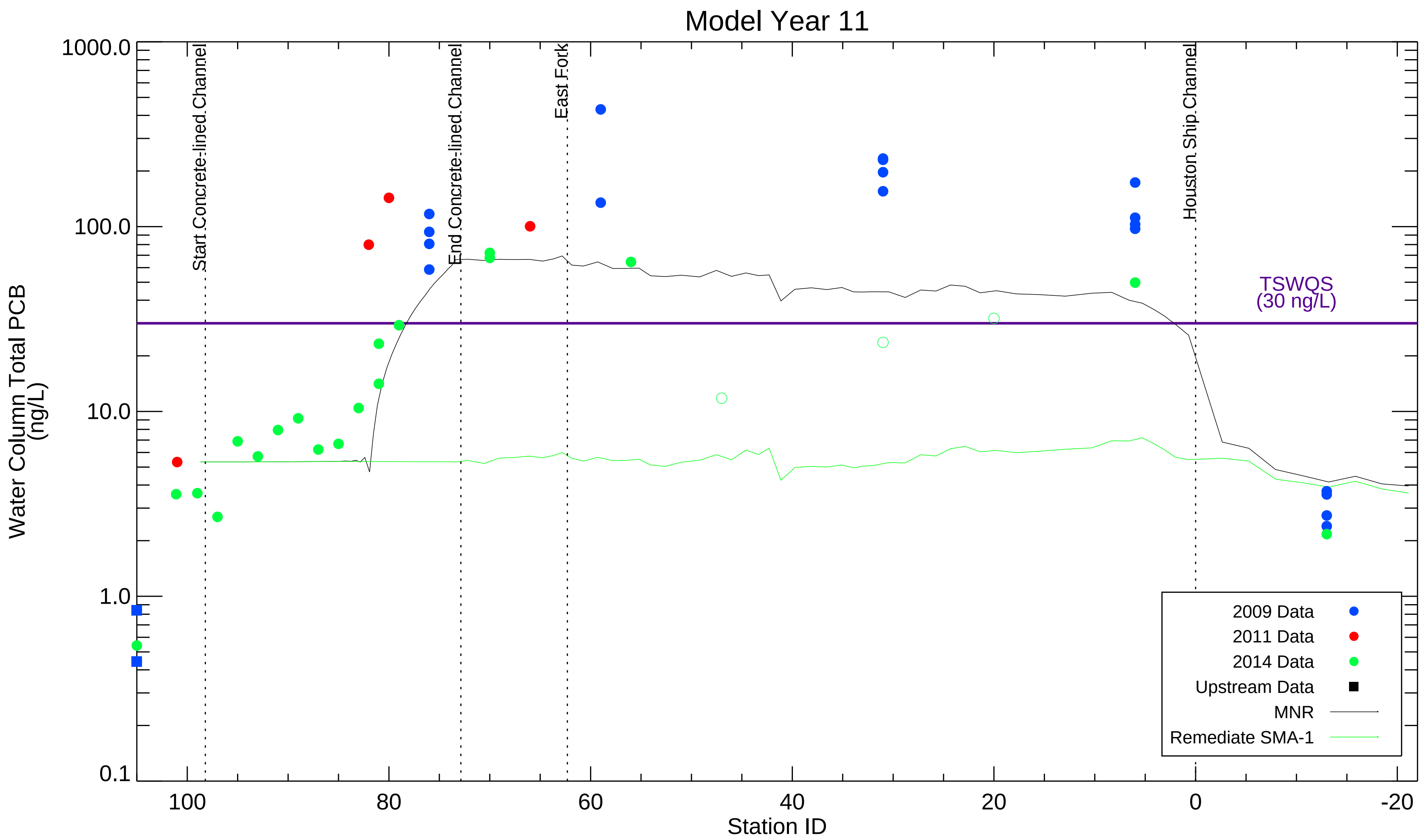

Model Run: PB_PROJ1_PCB-TOT_1406-32, PB_PROJ2_PCB-TOT_1406-34

Figure 4-2k

Spatial Profile of Model-predicted Water Column Total PCB Concentration for MNR and Remediation of SMA-1

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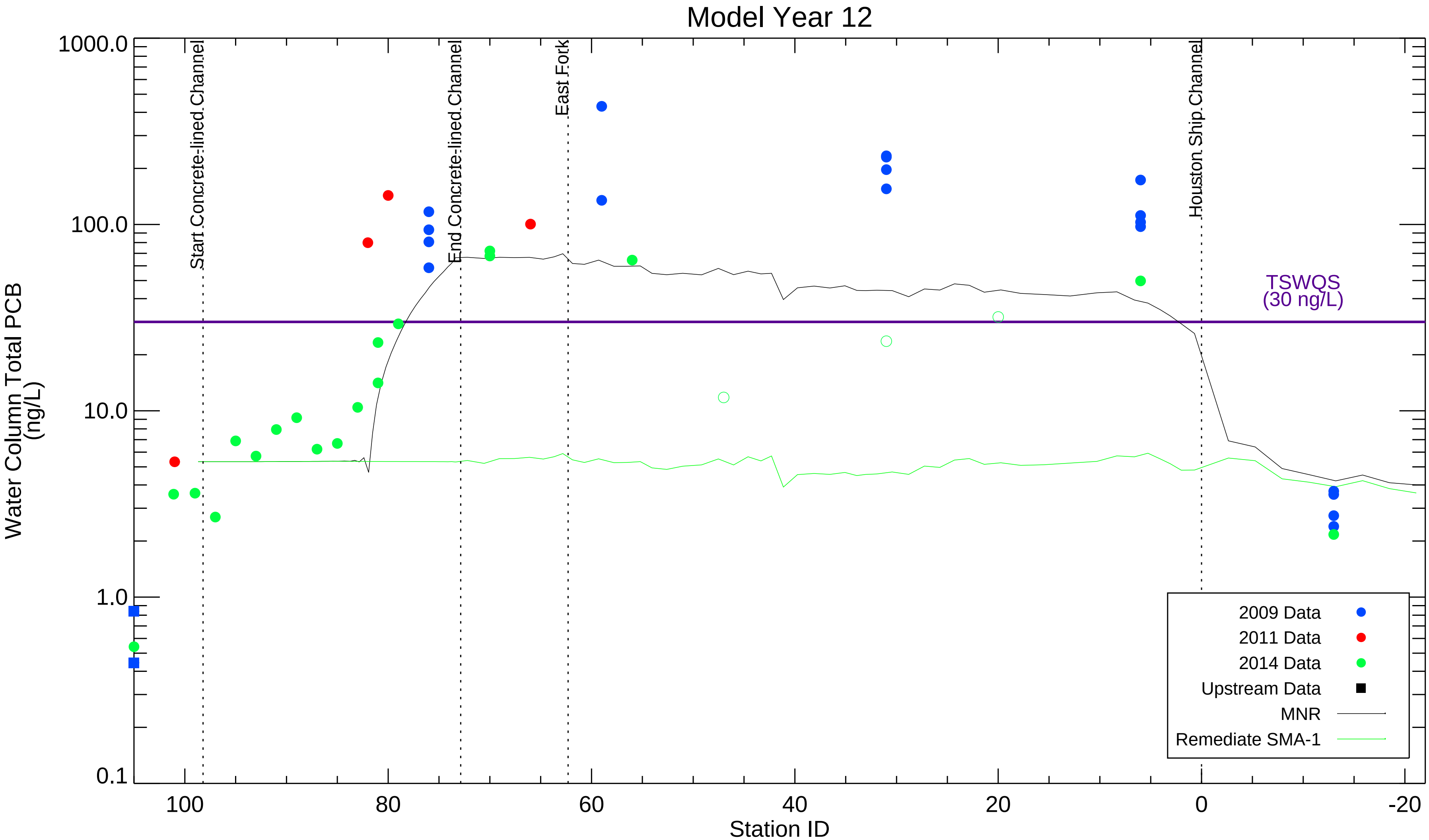

Model Run: PB_PROJ1_PCB-TOT_1406-32, PB_PROJ2_PCB-TOT_1406-34

Figure 4-2l

Spatial Profile of Model-predicted Water Column Total PCB Concentration for MNR and Remediation of SMA-1

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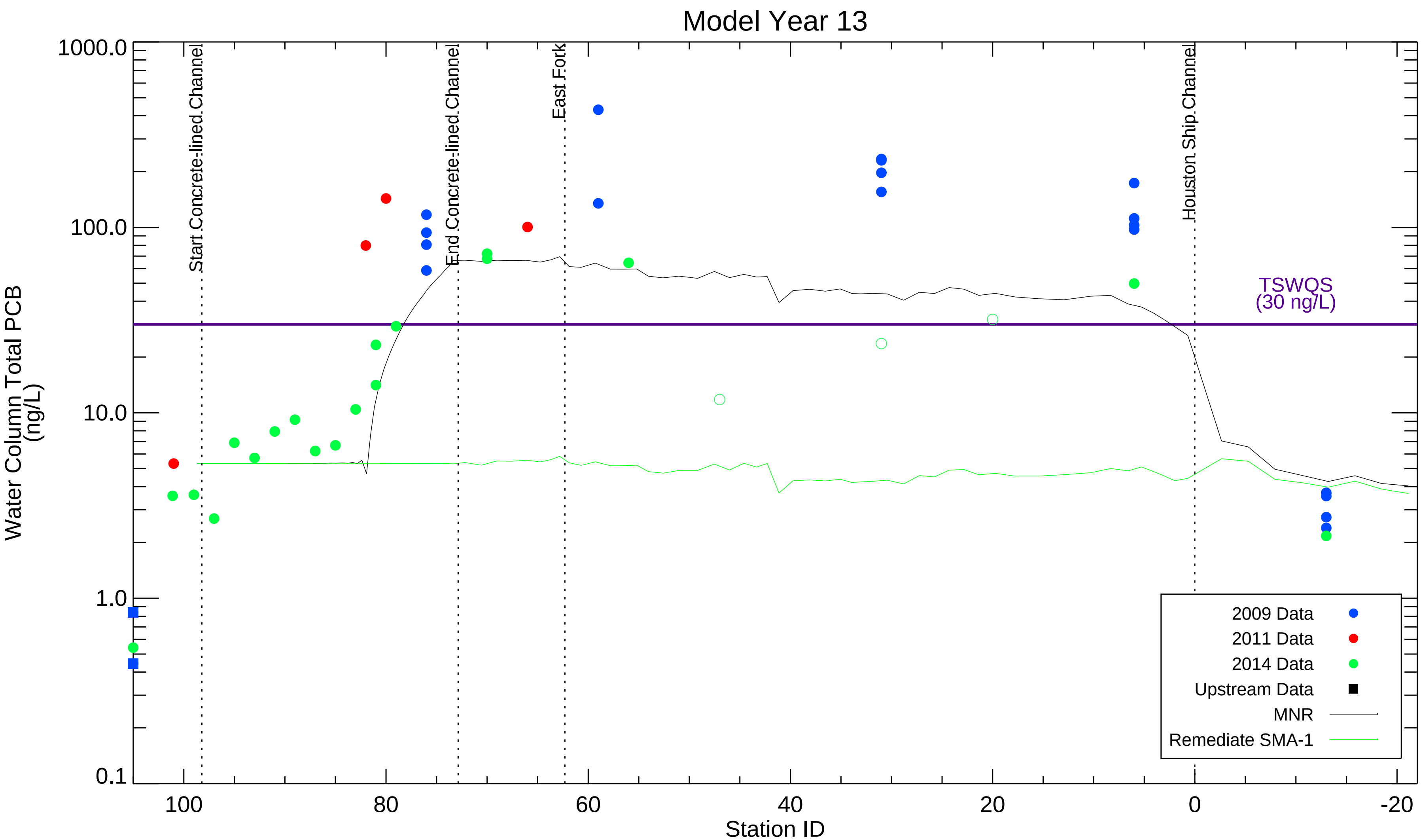

Model Run: PB_PROJ1_PCB-TOT_1406-32, PB_PROJ2_PCB-TOT_1406-34

Figure 4-2m

Spatial Profile of Model-predicted Water Column Total PCB Concentration for MNR and Remediation of SMA-1

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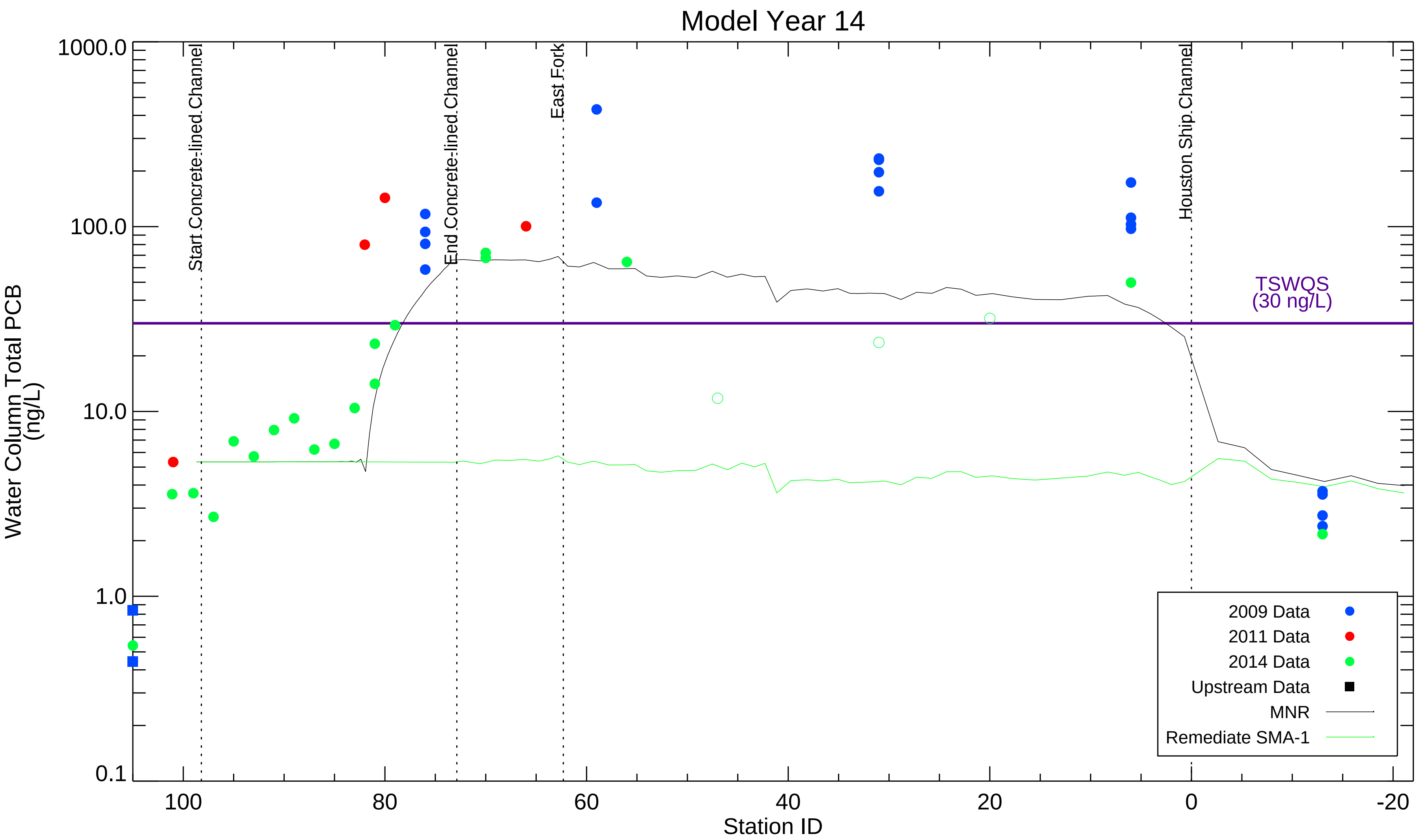

Model Run: PB_PROJ1_PCB-TOT_1406-32, PB_PROJ2_PCB-TOT_1406-34

Figure 4-2n

Spatial Profile of Model-predicted Water Column Total PCB Concentration for MNR and Remediation of SMA-1

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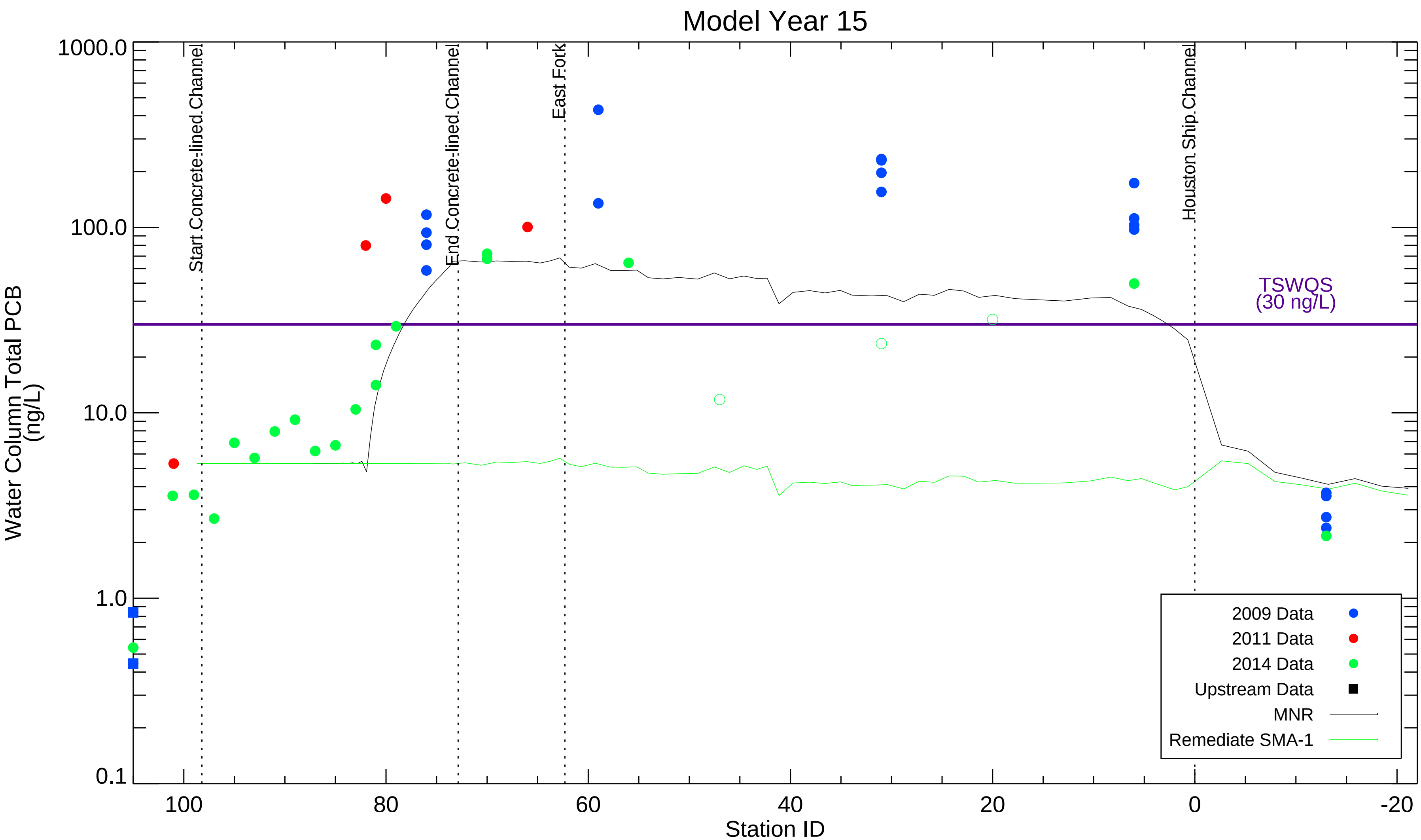
LHB - \\helios\aq\D_Drive\Projects\Patrick_Bayou_Joint_Defense_Group\Patrick_Bayou(040284-01)\MODEL\EFDC\Post_process\Water_Column\plot\plot_all\PB_WC_data_spatial_depth_avg_longterm_oplot_Cal_Proj.pro Thu Sep 04 15:53:52 2014



Model Run: PB_PROJ1_PCB-TOT_1406-32, PB_PROJ2_PCB-TOT_1406-34

Figure 4-2o

Spatial Profile of Model-predicted Water Column Total PCB Concentration for MNR and Remediation of SMA-1
Draft Feasibility Study Report
Patrick Bayou Superfund Site

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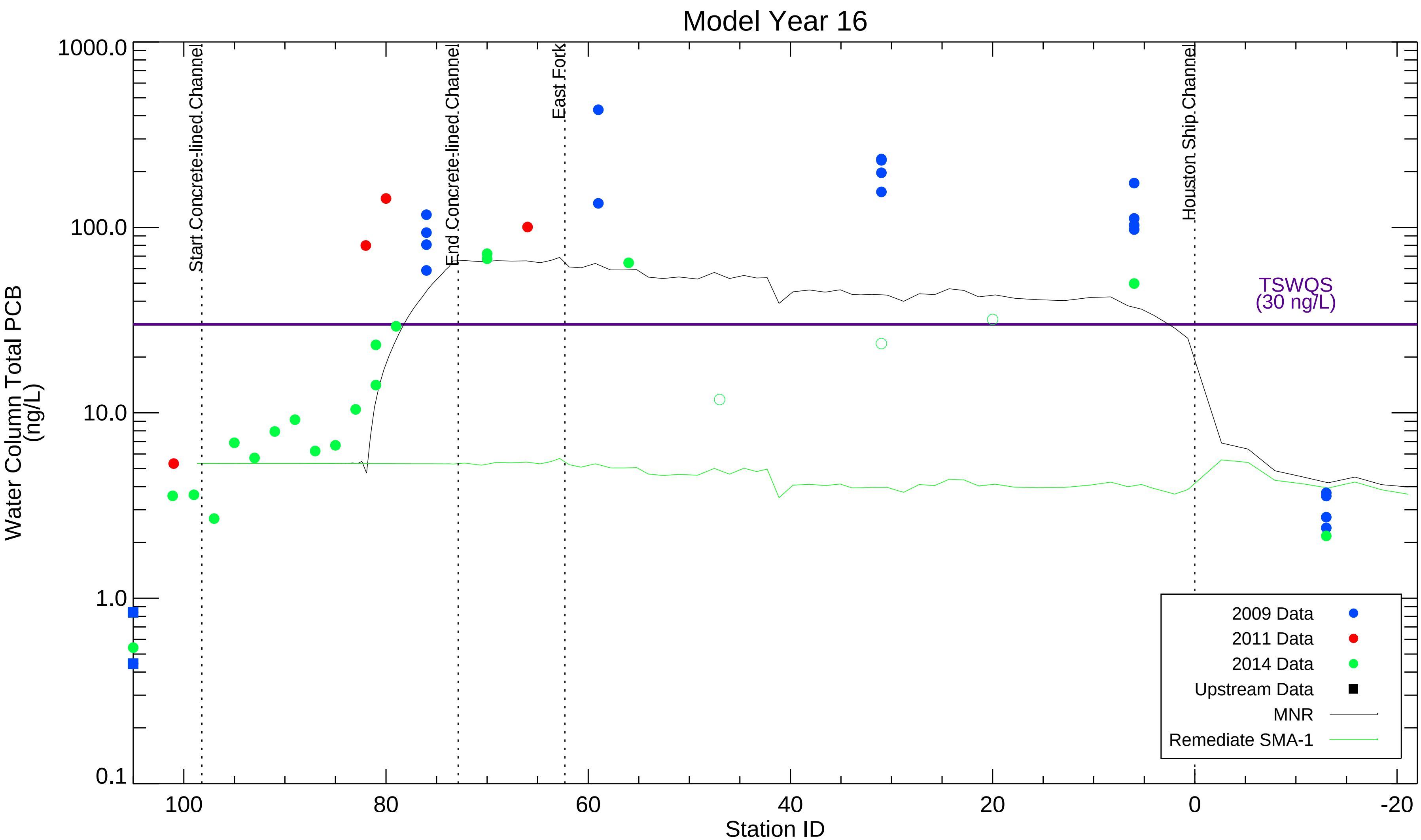
LHB - \\helios\aq\D_Drive\Projects\Patrick_Bayou_Joint_Defense_Group\Patrick_Bayou(040284-01)\MODEL\EFDC\Post_process\Water_Column\plot\plot_all\PB_WC_data_spatial_depth_avg_longterm_oplot_Cal_Proj.pro Thu Sep 04 15:54:15 2014



Model Run: PB_PROJ1_PCB-TOT_1406-32, PB_PROJ2_PCB-TOT_1406-34

Figure 4-2p

Spatial Profile of Model-predicted Water Column Total PCB Concentration for MNR and Remediation of SMA-1

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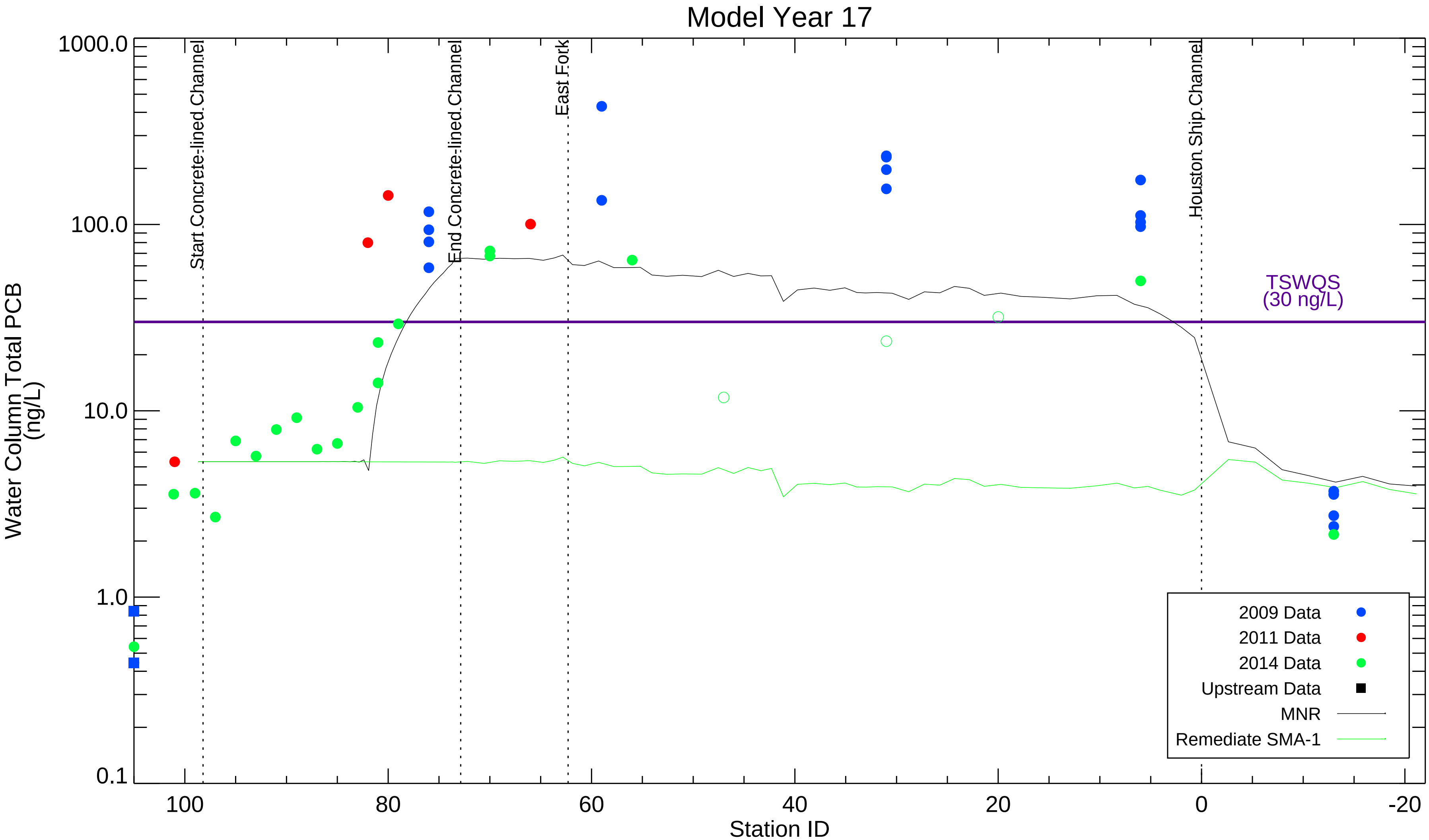

Model Run: PB_PROJ1_PCB-TOT_1406-32, PB_PROJ2_PCB-TOT_1406-34

Figure 4-2q

Spatial Profile of Model-predicted Water Column Total PCB Concentration for MNR and Remediation of SMA-1

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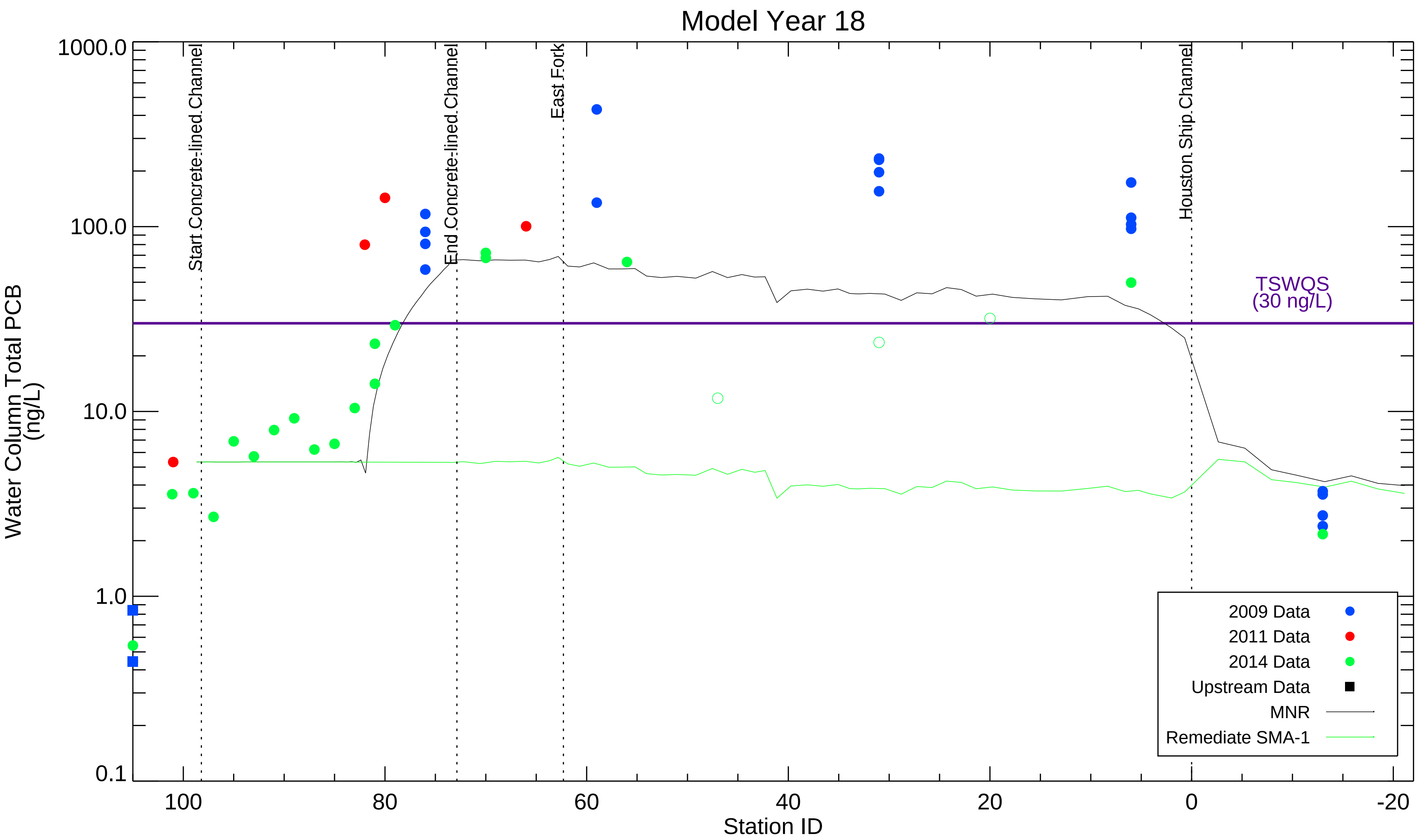

Model Run: PB_PROJ1_PCB-TOT_1406-32, PB_PROJ2_PCB-TOT_1406-34

Figure 4-2r

Spatial Profile of Model-predicted Water Column Total PCB Concentration for MNR and Remediation of SMA-1

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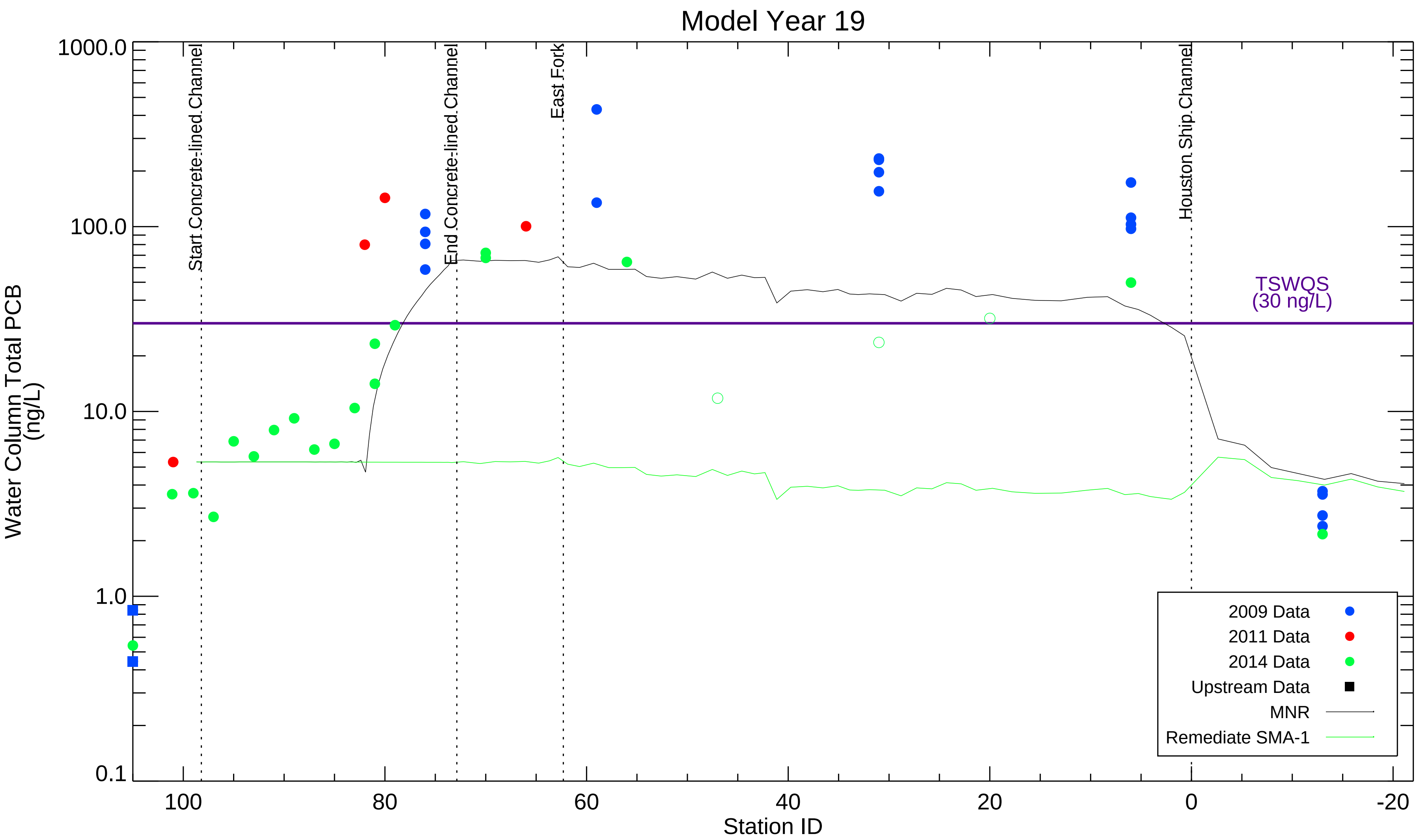

Model Run: PB_PROJ1_PCB-TOT_1406-32, PB_PROJ2_PCB-TOT_1406-34

Figure 4-2s

Spatial Profile of Model-predicted Water Column Total PCB Concentration for MNR and Remediation of SMA-1

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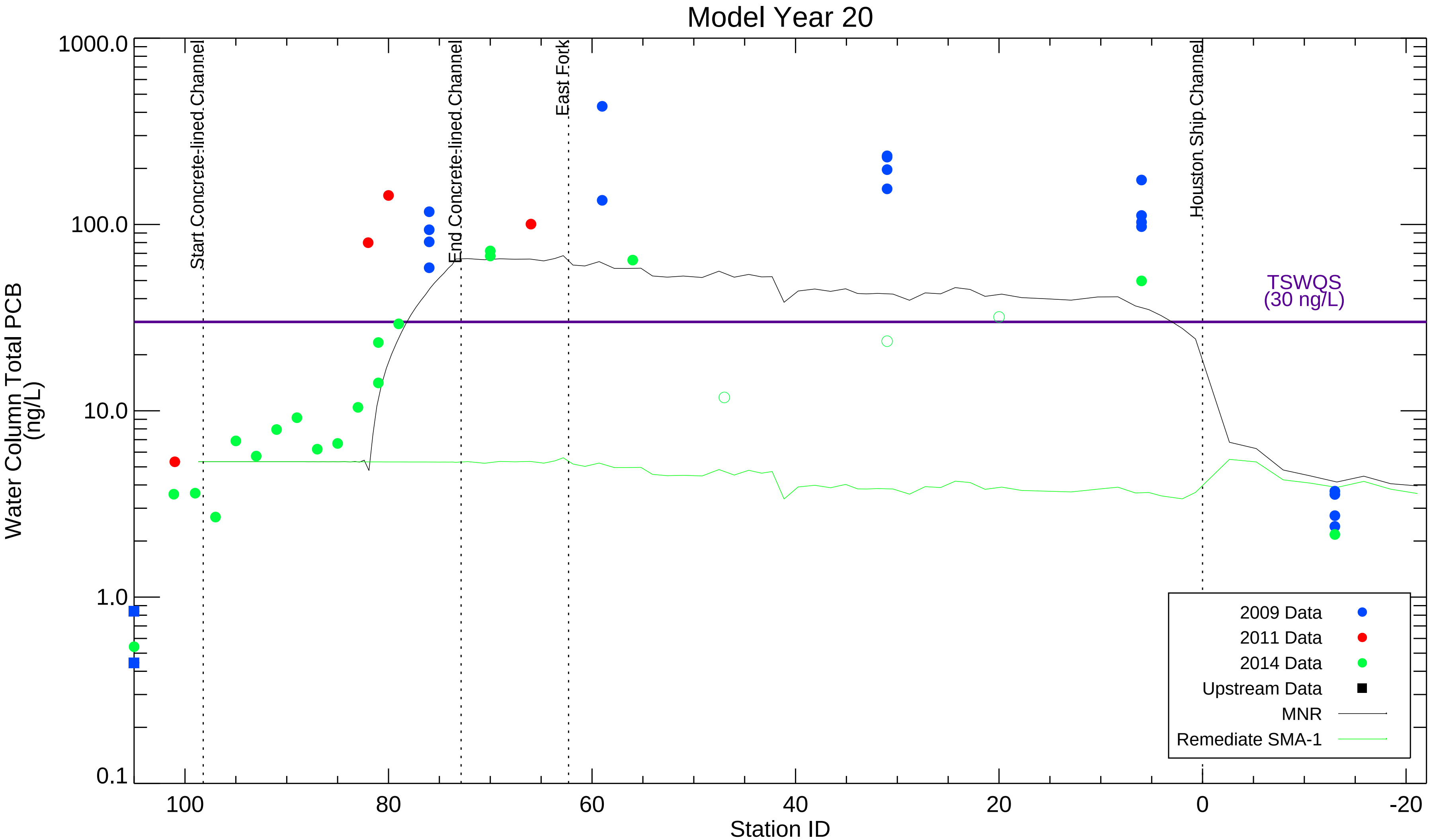

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Figure 4-2t

Spatial Profile of Model-predicted Water Column Total PCB Concentration for MNR and Remediation of SMA-1

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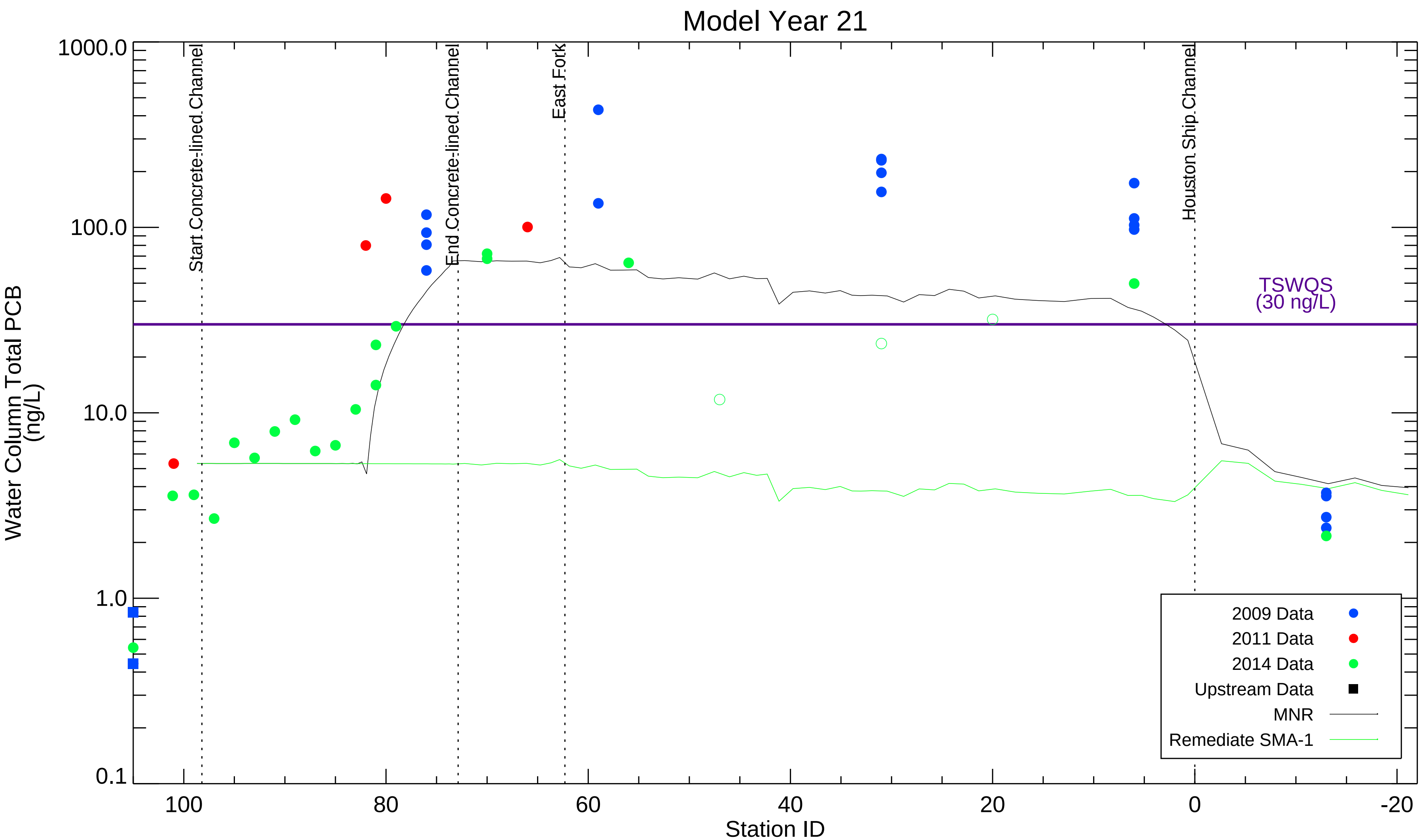

Model Run: PB_PROJ1_PCB-TOT_1406-32, PB_PROJ2_PCB-TOT_1406-34

Figure 4-2u

Spatial Profile of Model-predicted Water Column Total PCB Concentration for MNR and Remediation of SMA-1

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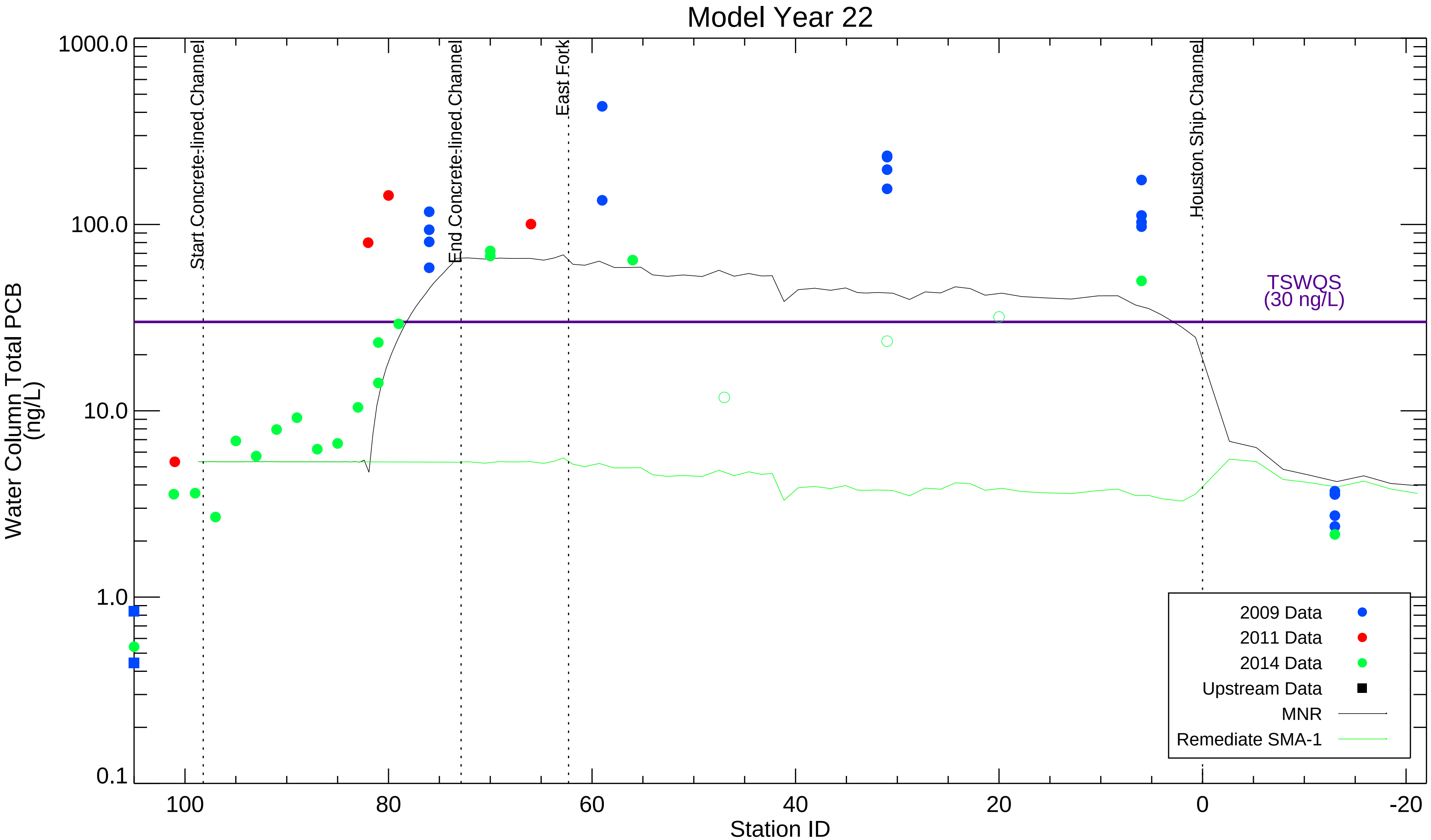

Model Run: PB_PROJ1_PCB-TOT_1406-32, PB_PROJ2_PCB-TOT_1406-34

Figure 4-2v

Spatial Profile of Model-predicted Water Column Total PCB Concentration for MNR and Remediation of SMA-1

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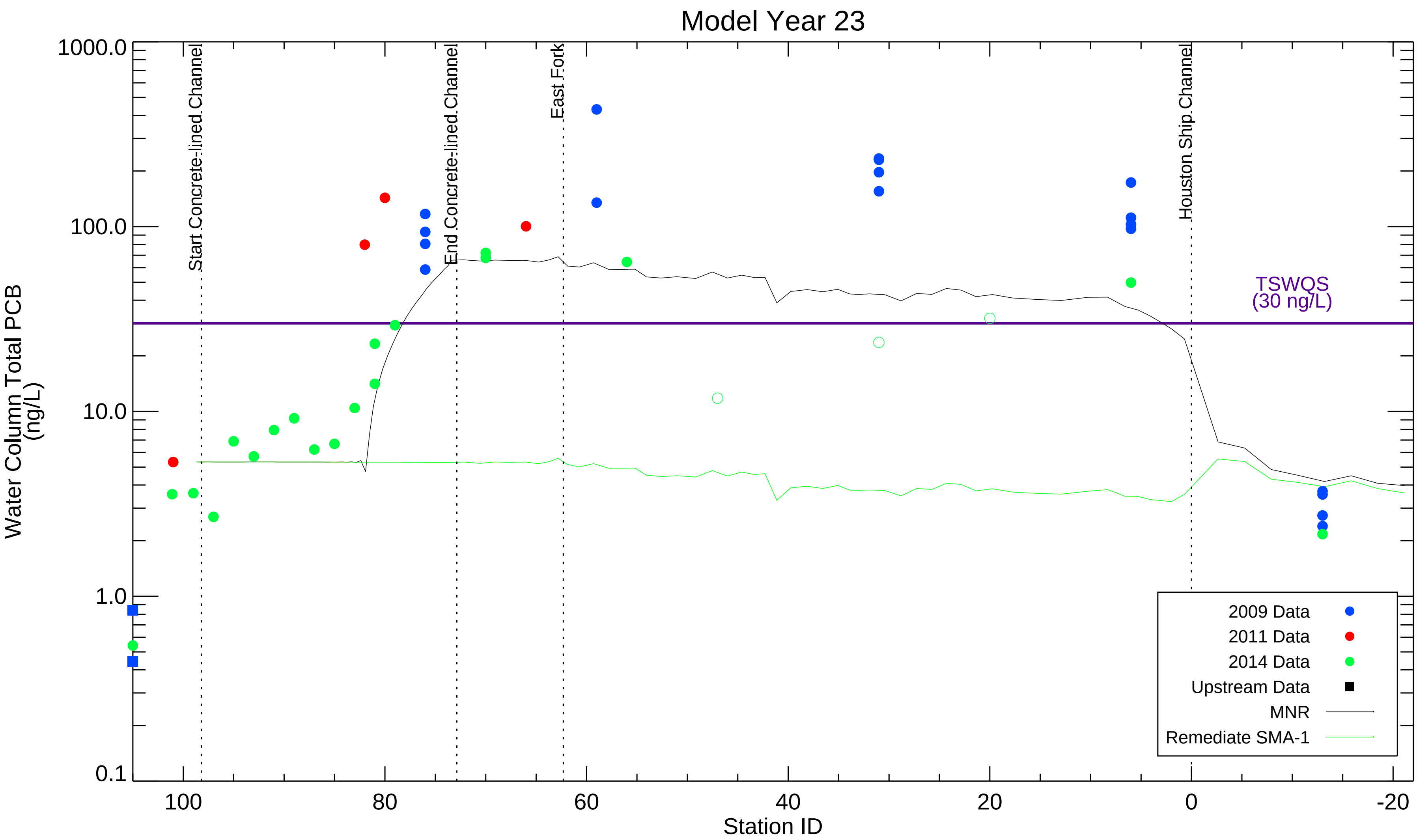
LHB - \\helios\aq\D_Drive\Projects\Patrick_Bayou_Joint_Defense_Group\Patrick_Bayou(040284-01)\MODEL\EFDC\Post_process\Water_Column\plot\plot_all\PB_WC_data_spatial_depth_avg_longterm_oplot_Cal_Proj.pro Thu Sep 04 15:56:57 2014



Model Run: PB_PROJ1_PCB-TOT_1406-32, PB_PROJ2_PCB-TOT_1406-34

Figure 4-2w

Spatial Profile of Model-predicted Water Column Total PCB Concentration for MNR and Remediation of SMA-1

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LHB - \\helios\aq\D_Drive\Projects\Patrick_Bayou_Joint_Defense_Group\Patrick_Bayou(040284-01)\MODEL\EFDC\Post_process\Water_Column\plot\plot_all\PB_WC_data_spatial_depth_avg_longterm_oplot_Cal_Proj.pro Thu Sep 04 15:57:22 2014

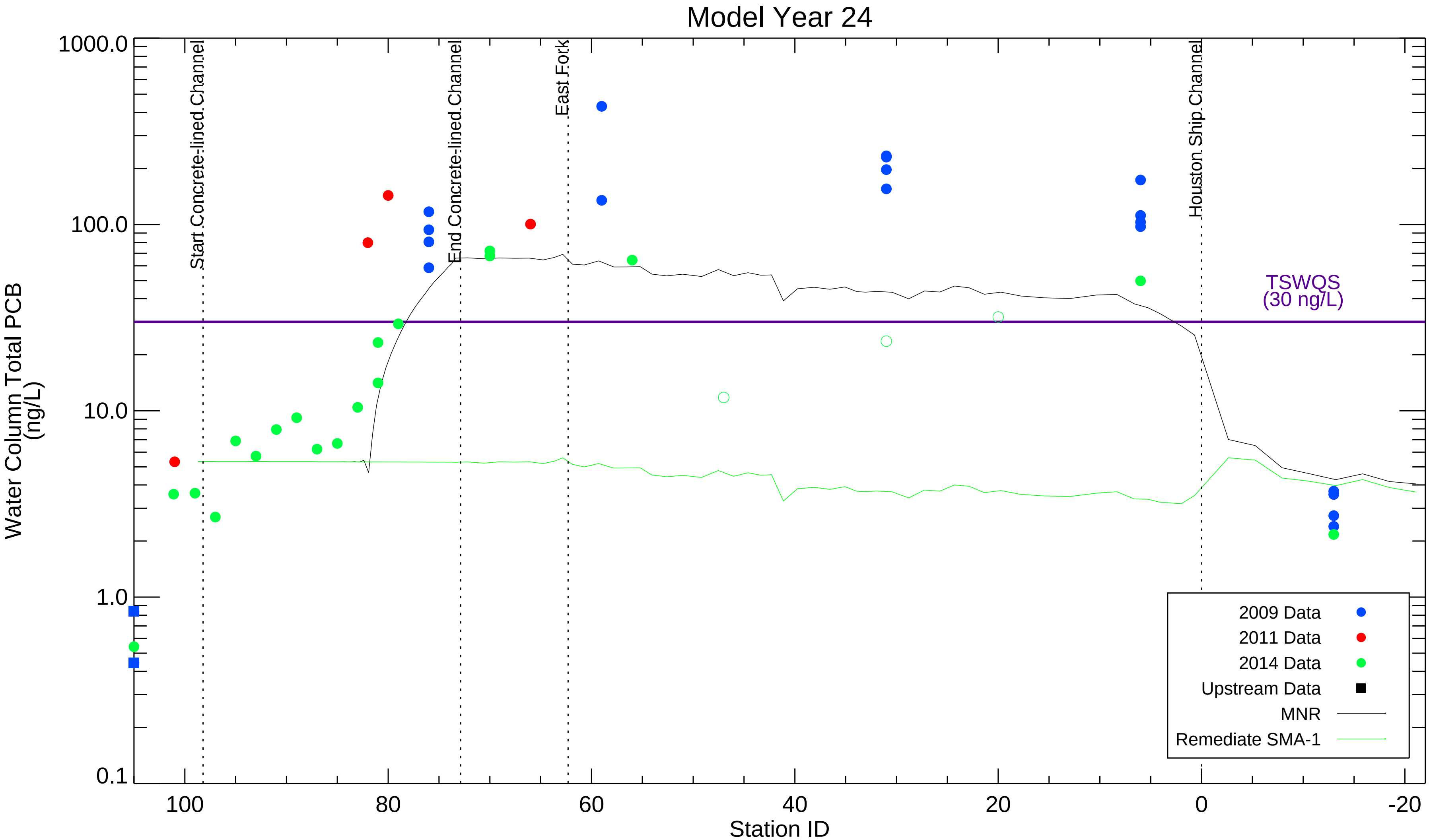

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Figure 4-2x

Spatial Profile of Model-predicted Water Column Total PCB Concentration for MNR and Remediation of SMA-1

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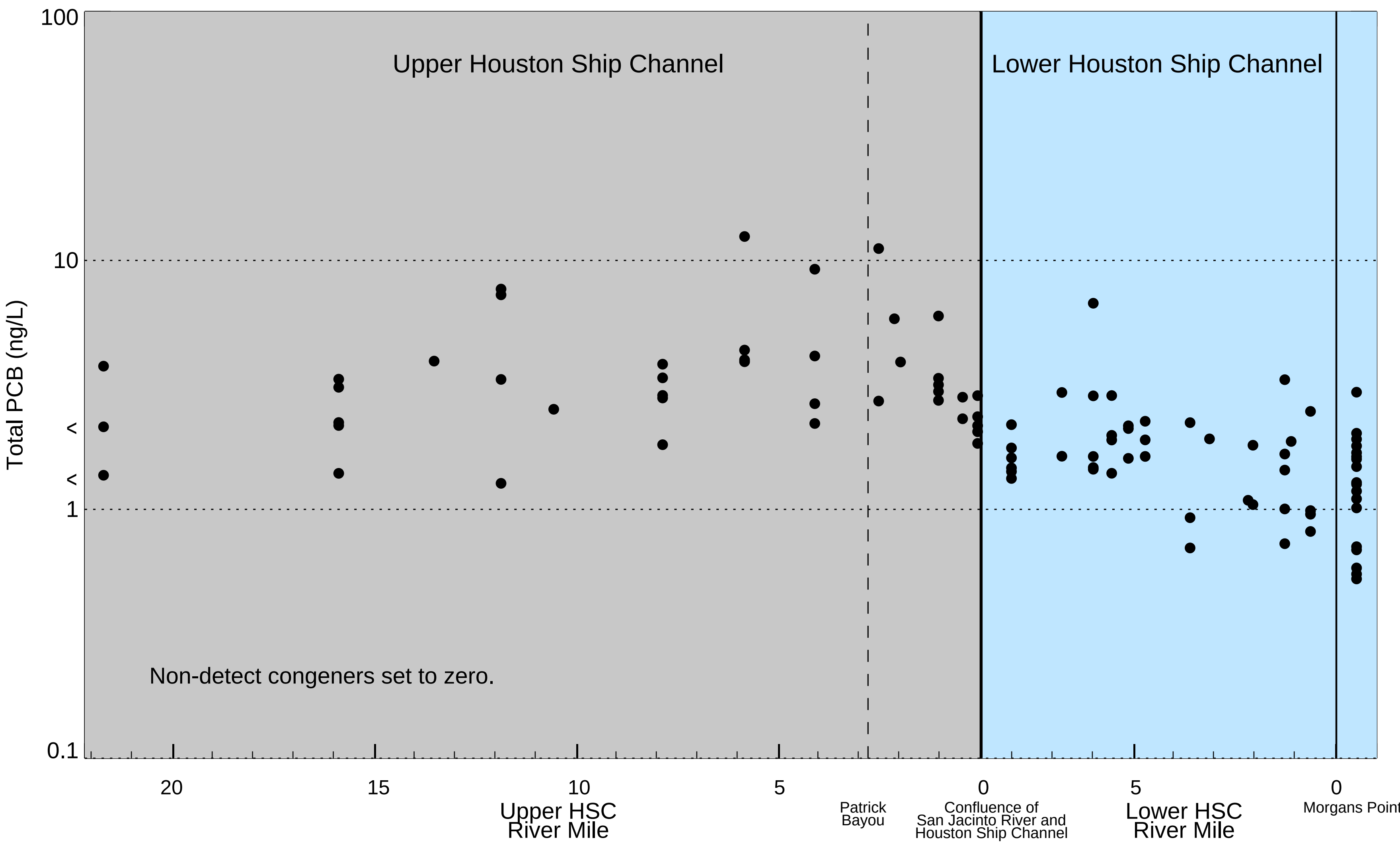


● TCEQ TMDL Study Data

Exhibit 1

Spatial profile of water column Total PCB in the Houston Ship Channel

Nondetects set to 0 and are plotted with open symbols. Samples from Galveston Bay assigned river mile -0.5.
Studies included: TMDLTCEQ, TMDLTCEQ_PCB, Patrick Bayou RI

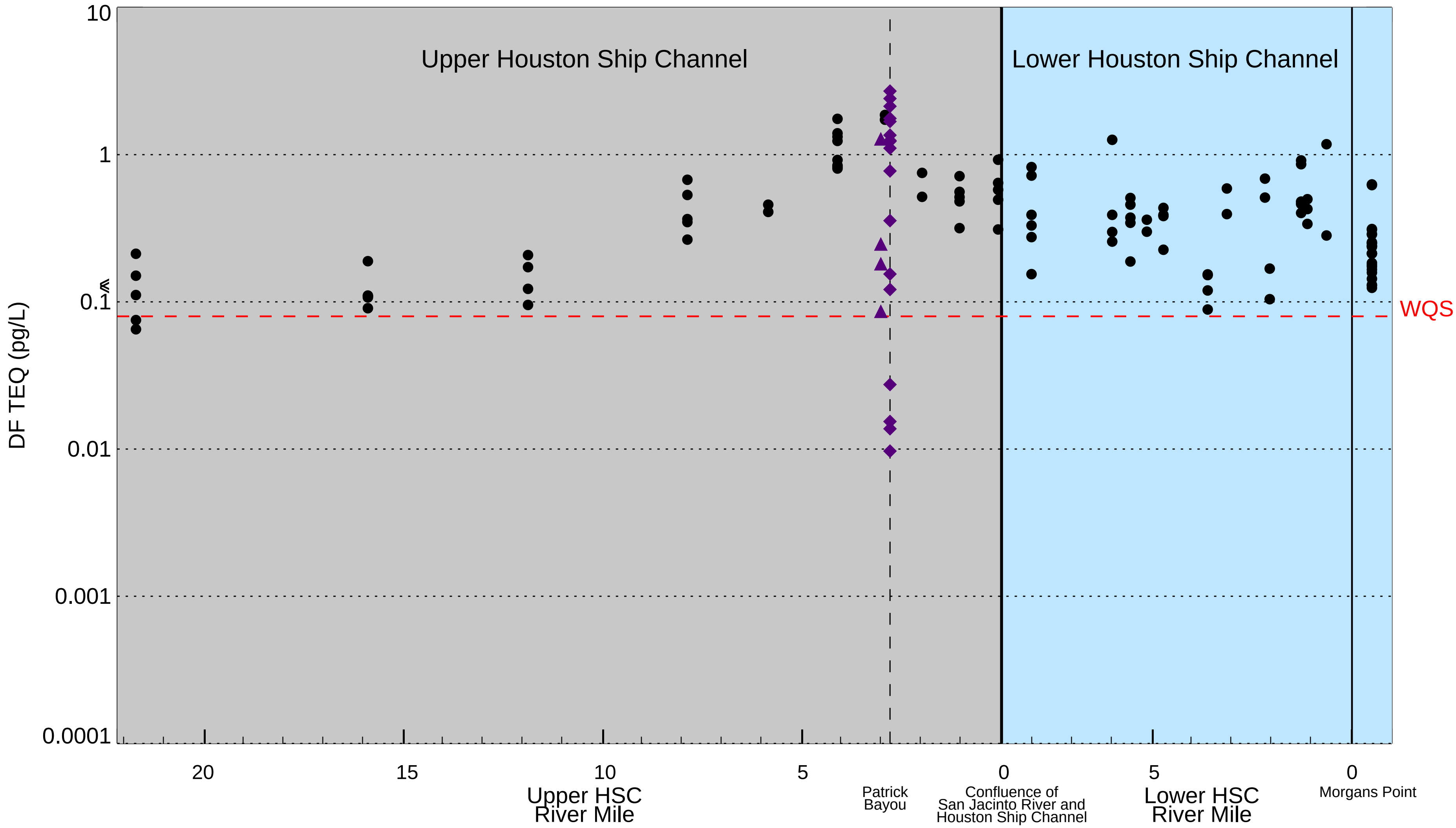


Exhibit 2

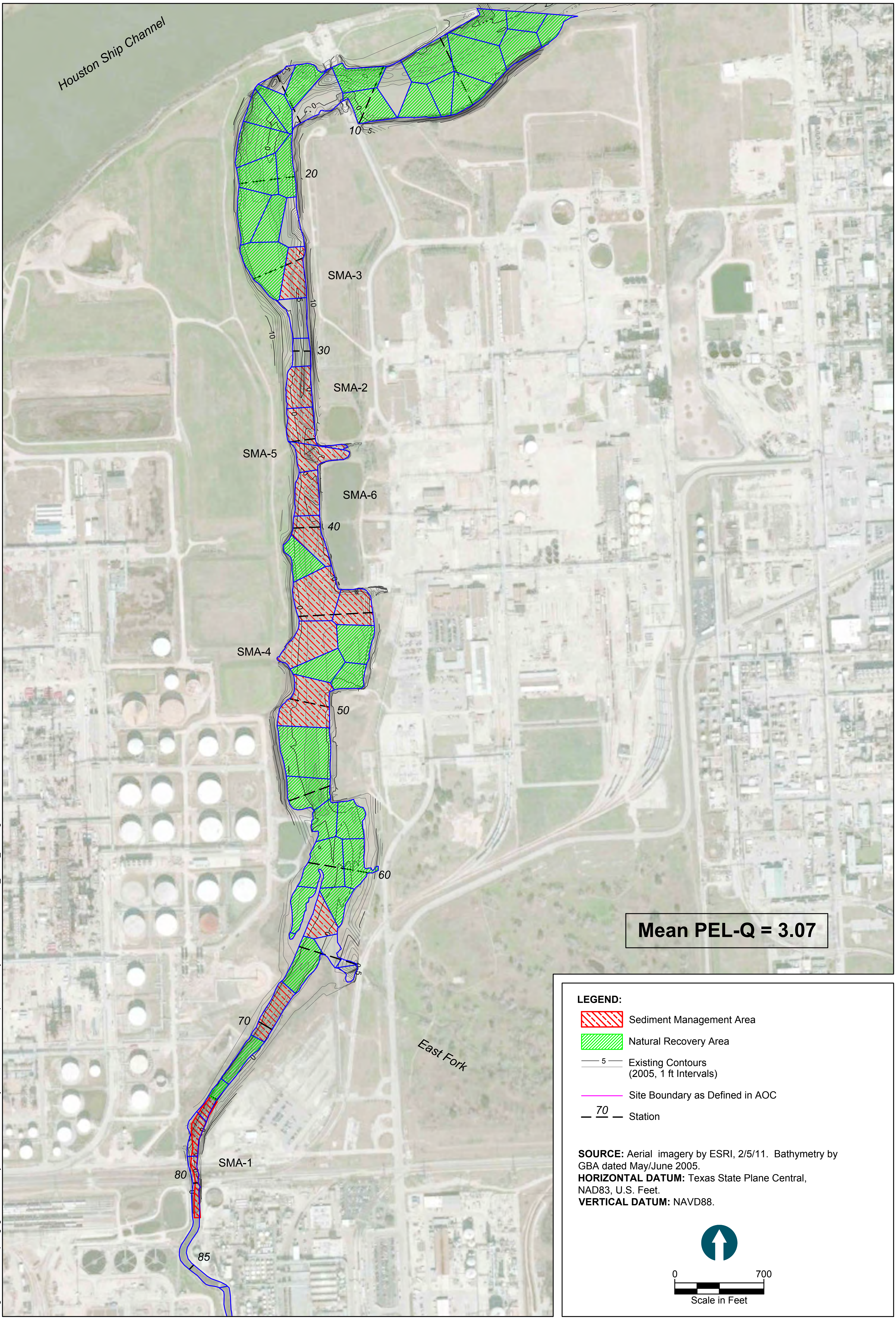
Spatial profile of water column DF TEQ in the Houston Ship Channel

Nondetects set to 0 and are plotted with open symbols. Samples from Galveston Bay assigned river mile -0.5.
Studies included: TCEQ_2009, TMDLTCEQ, Patrick Bayou RI
DF TEQ: Dioxin/Furan Toxic Equivalents.
TEQs were calculated using TEFs from TSWQ2014.

ANCHOR QEA

● TCEQ TMDL Study Data
Patrick Bayou RI data
◆ Patrick Bayou Data
▲ Houston Ship Channel Data

MJR/ZL - C:\D_Drive\Projects\Patric_Bayou\PB_plot_spatial_chem_wat_1Panel_RI_ND_included_DF_Only.pro Tue Aug 25 15:27:37 2015



Aug 31, 2015 5:17pm tgriga K:\Projects\0284-Patrick Bayou Joint Defense Group\Patrick Bayou 2013\0284-RP-012_PELQ_307.dwg Exhibit 3

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Exhibit 3
Sediment Management Areas
Response to July 8, 2015 Comments
Patrick Bayou Superfund Site

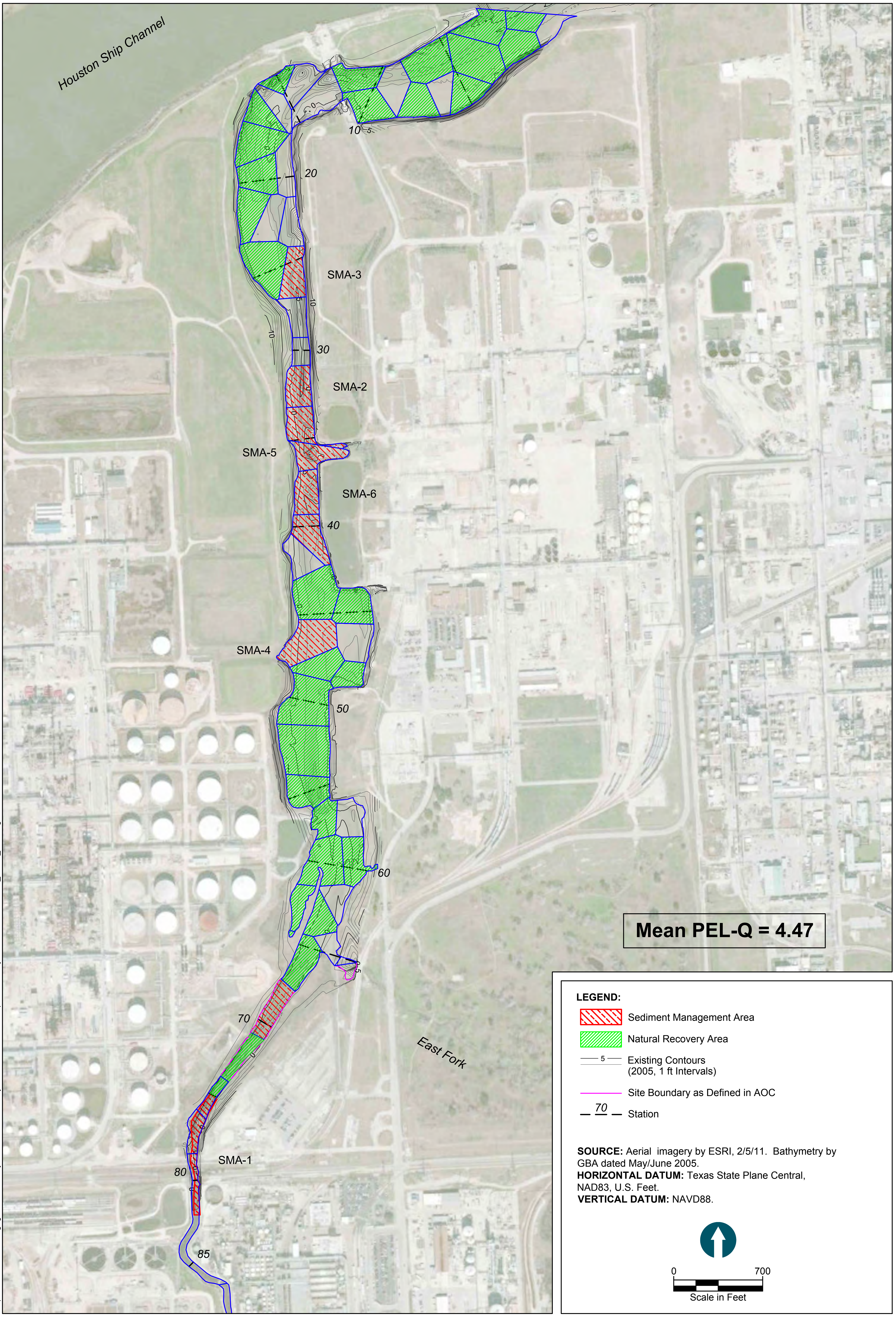

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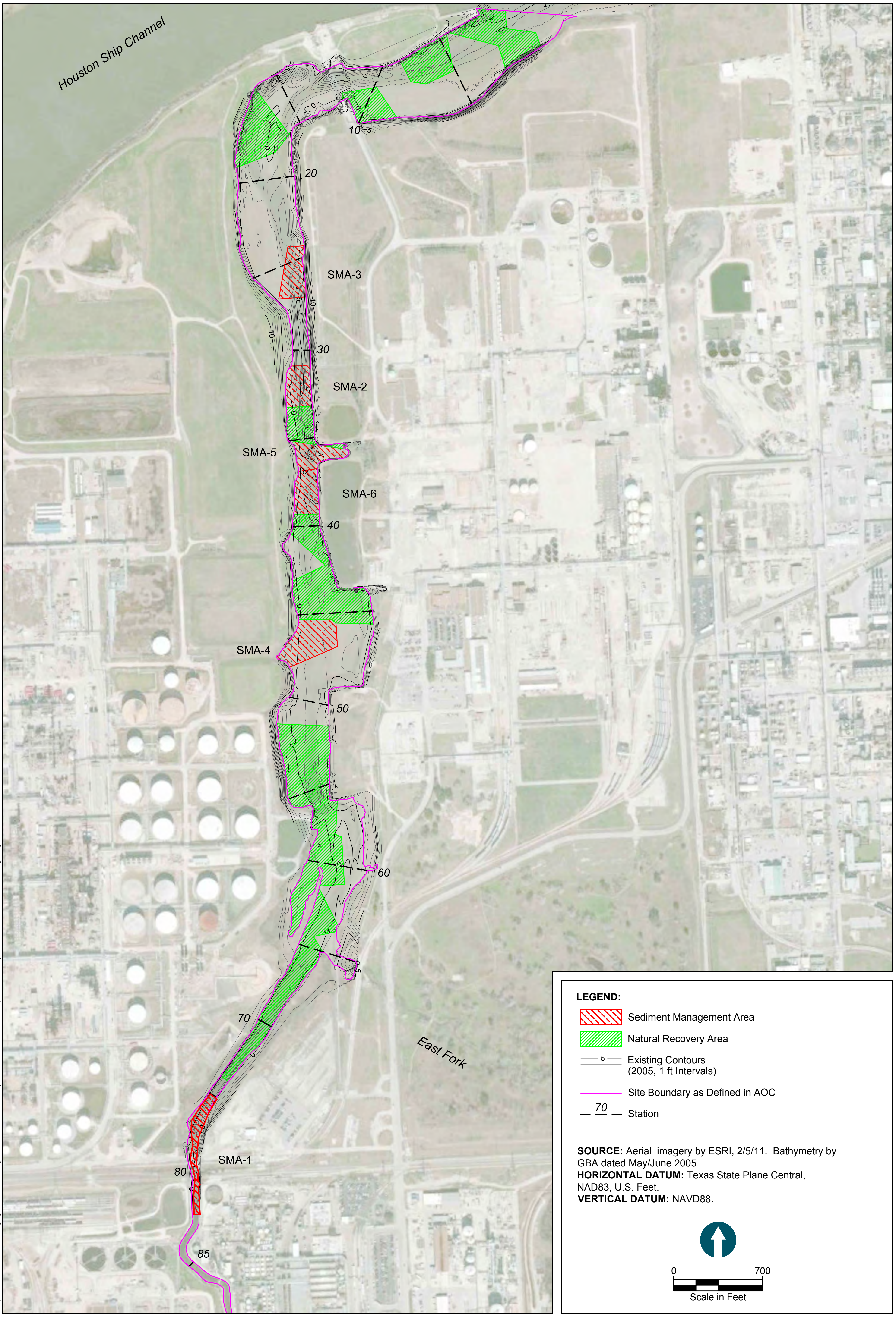
Exhibit 4
Sediment Management Areas
Response to July 8, 2015 Comments
Patrick Bayou Superfund Site



Sep 23, 2014 11:45am tgriga K:\Projects\0284-Patrick Bayou Joint Defense Group\Patrick Bayou 2013\0284-RP-008.dwg Figure 4-1

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Figure 4-1
Sediment Management Areas
Draft Feasibility Study
Patrick Bayou Superfund Site

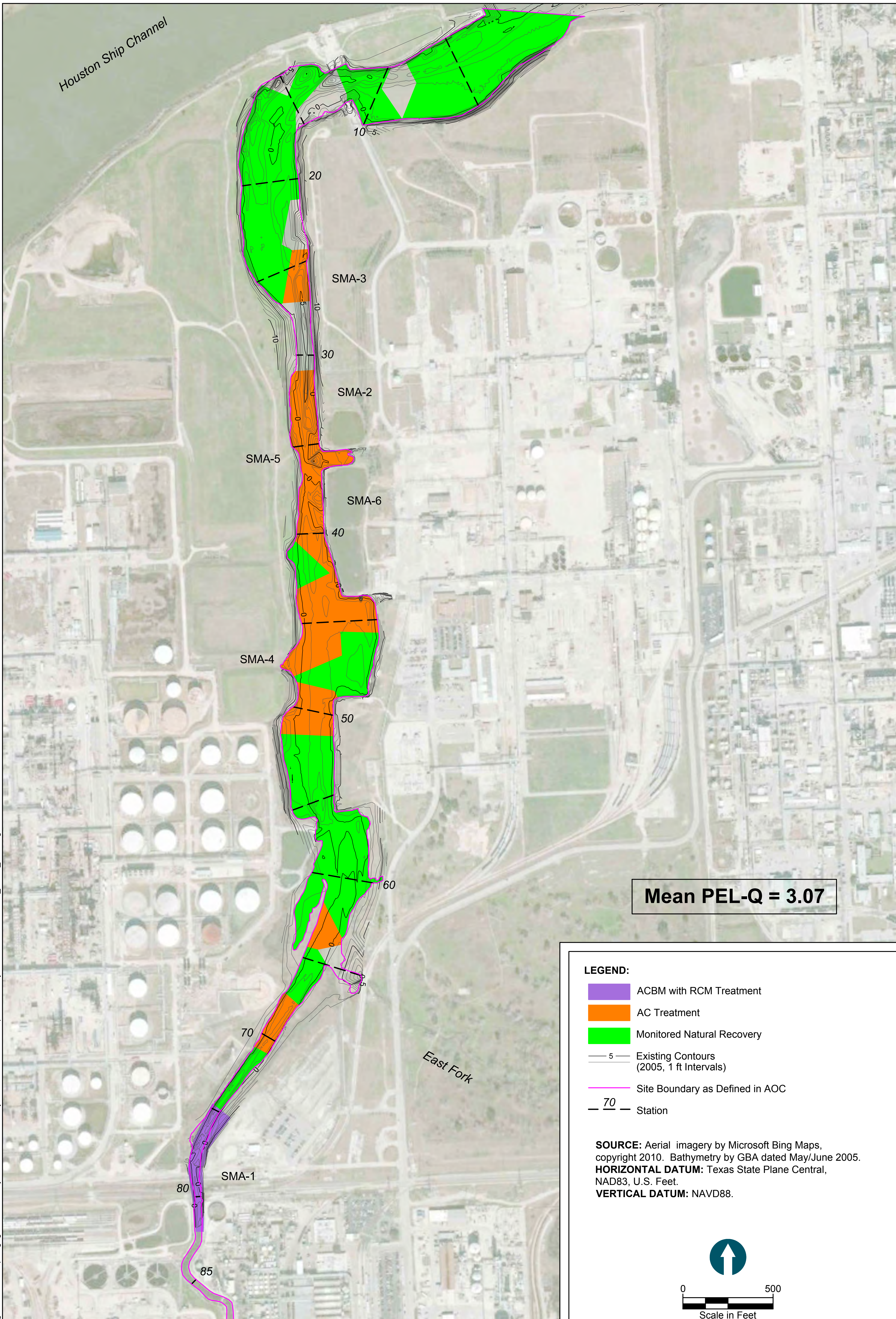

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Exhibit 5
Plan View Alternative 3: Monitored Natural Recovery, AC Treatment and ACBM
Response to July 8, 2015 Comments
Patrick Bayou Superfund Site

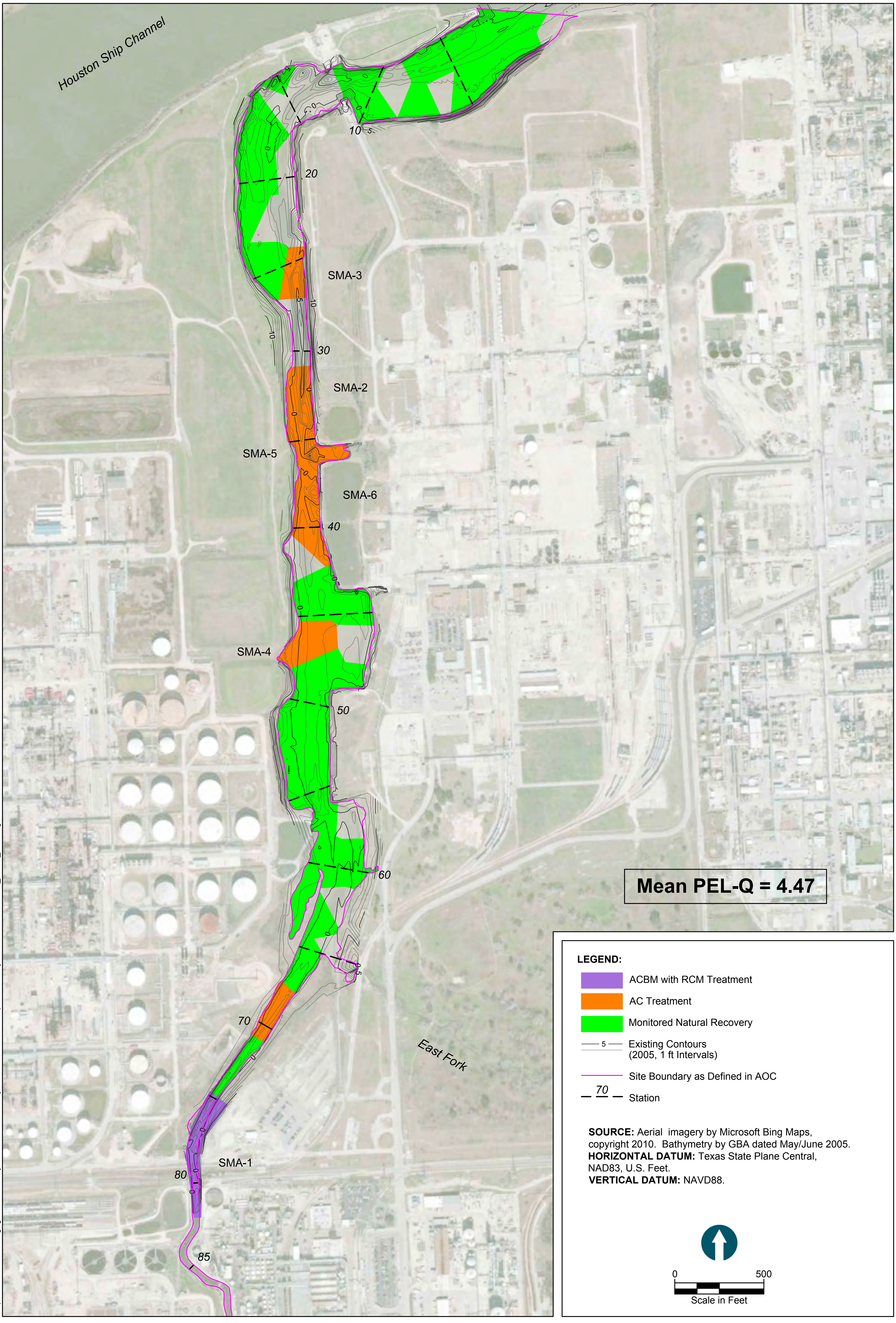

Exhibit 6

Plan View Alternative 3: Monitored Natural Recovery, AC Treatment and ACBM

Response to July 8, 2015 Comments

Patrick Bayou Superfund Site

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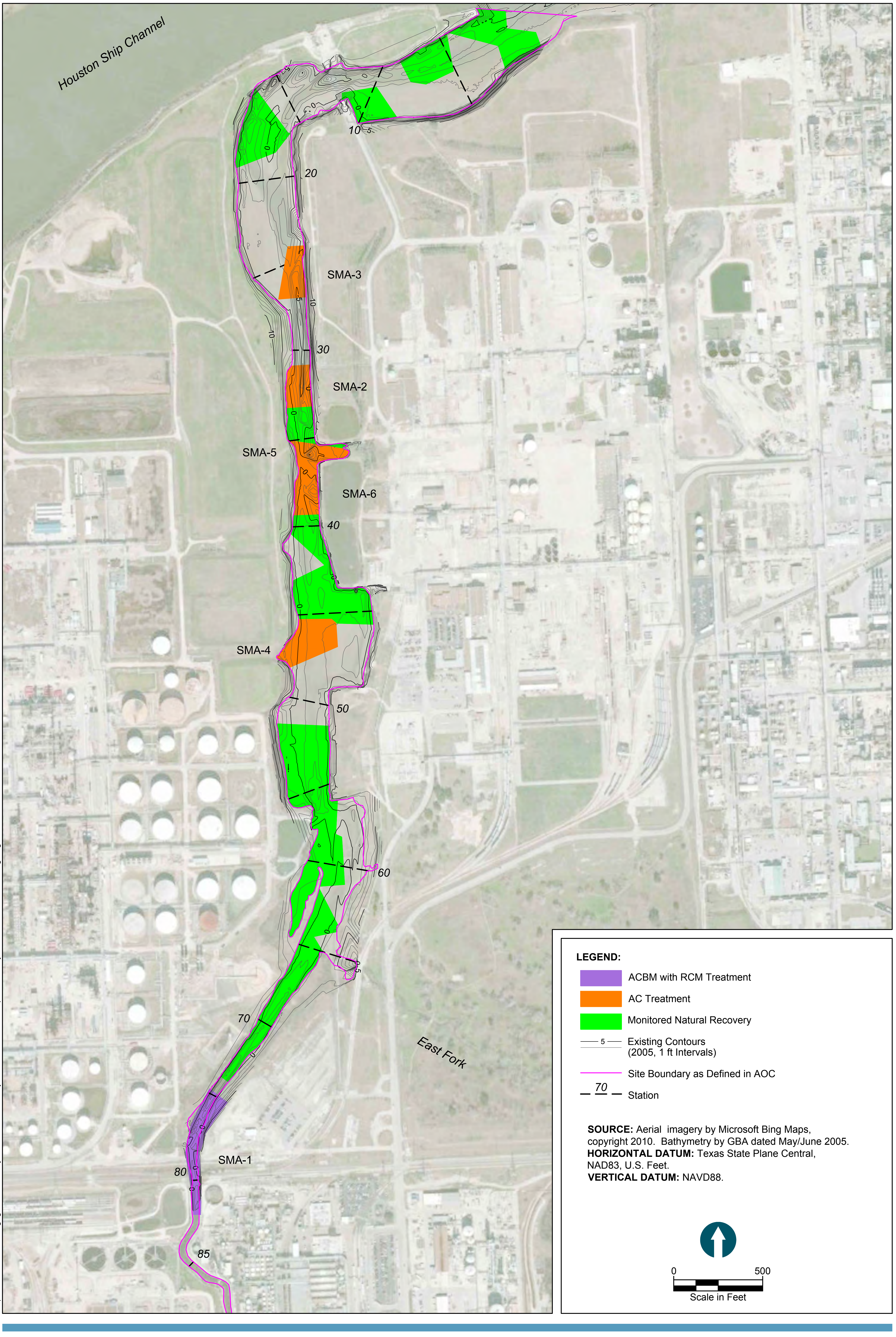

Sep 23, 2014 11:45am tgriga K:\Projects\0284-Patrick Bayou Joint Defense Group\Patrick Bayou 2013\0284-RP-008.dwg Figure 4-4

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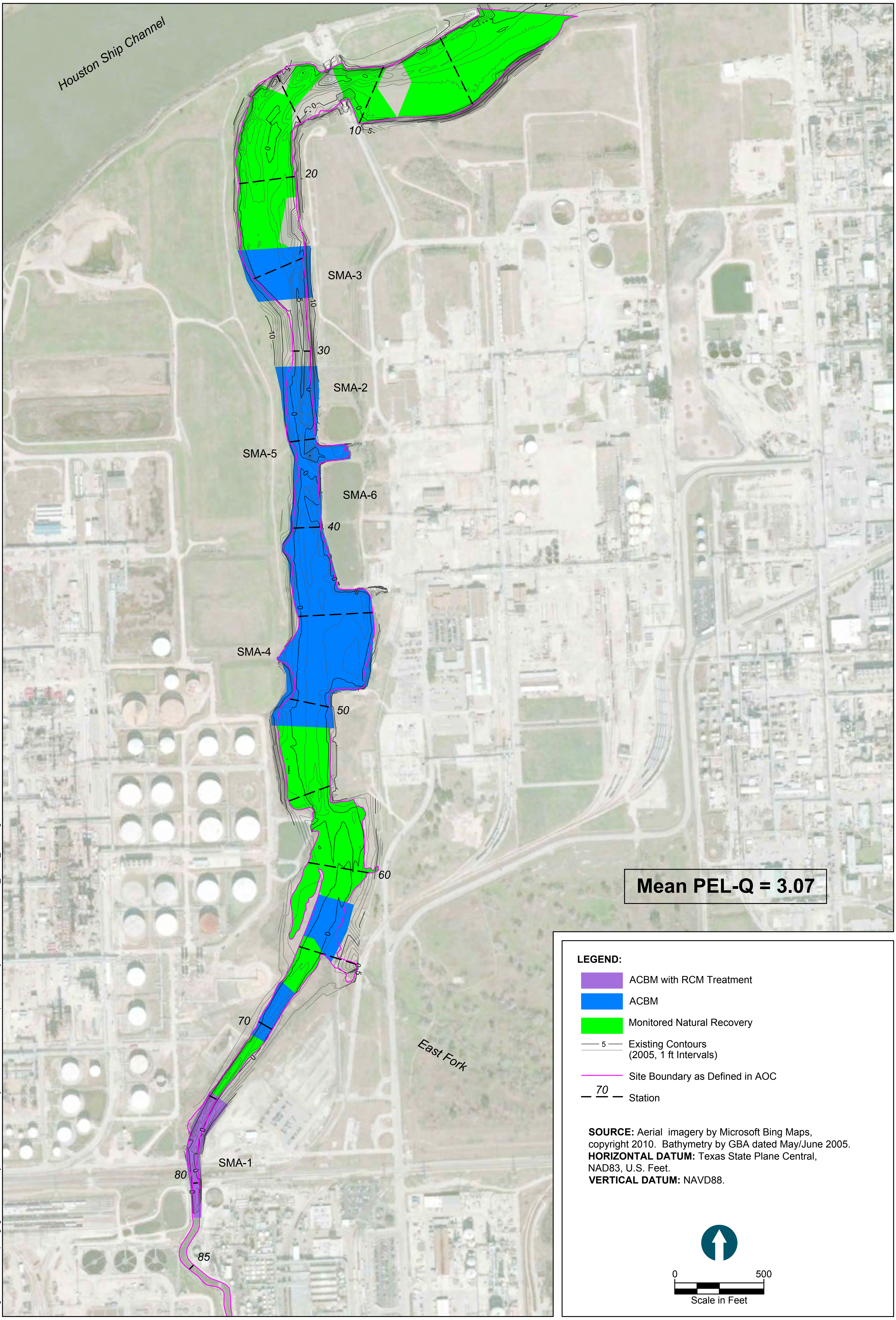
Figure 4-4
Plan View Alternative 3: Monitored Natural Recovery, AC Treatment and ACBM
Draft Feasibility Study
Patrick Bayou Superfund Site



LEGEND:

- ACBM with RCM Treatment
- ACBM
- Monitored Natural Recovery
- Existing Contours (2005, 1 ft Intervals)
- Site Boundary as Defined in AOC
- Station

SOURCE: Aerial imagery by Microsoft Bing Maps, copyright 2010. Bathymetry by GBA dated May/June 2005.
HORIZONTAL DATUM: Texas State Plane Central, NAD83, U.S. Feet.
VERTICAL DATUM: NAVD88.

0 500
Scale in Feet

Aug 31, 2015 5:17pm tgriga K:\Projects\0284-Patrick Bayou Joint Defense Group\Patrick Bayou 2013\0284-RP-012_PELQ_307.dwg Exhibit 6

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Exhibit 7
Plan View Alternative 4: Monitored Natural Recovery Zones and ACBM
Response to July 8, 2015 Comments
Patrick Bayou Superfund Site

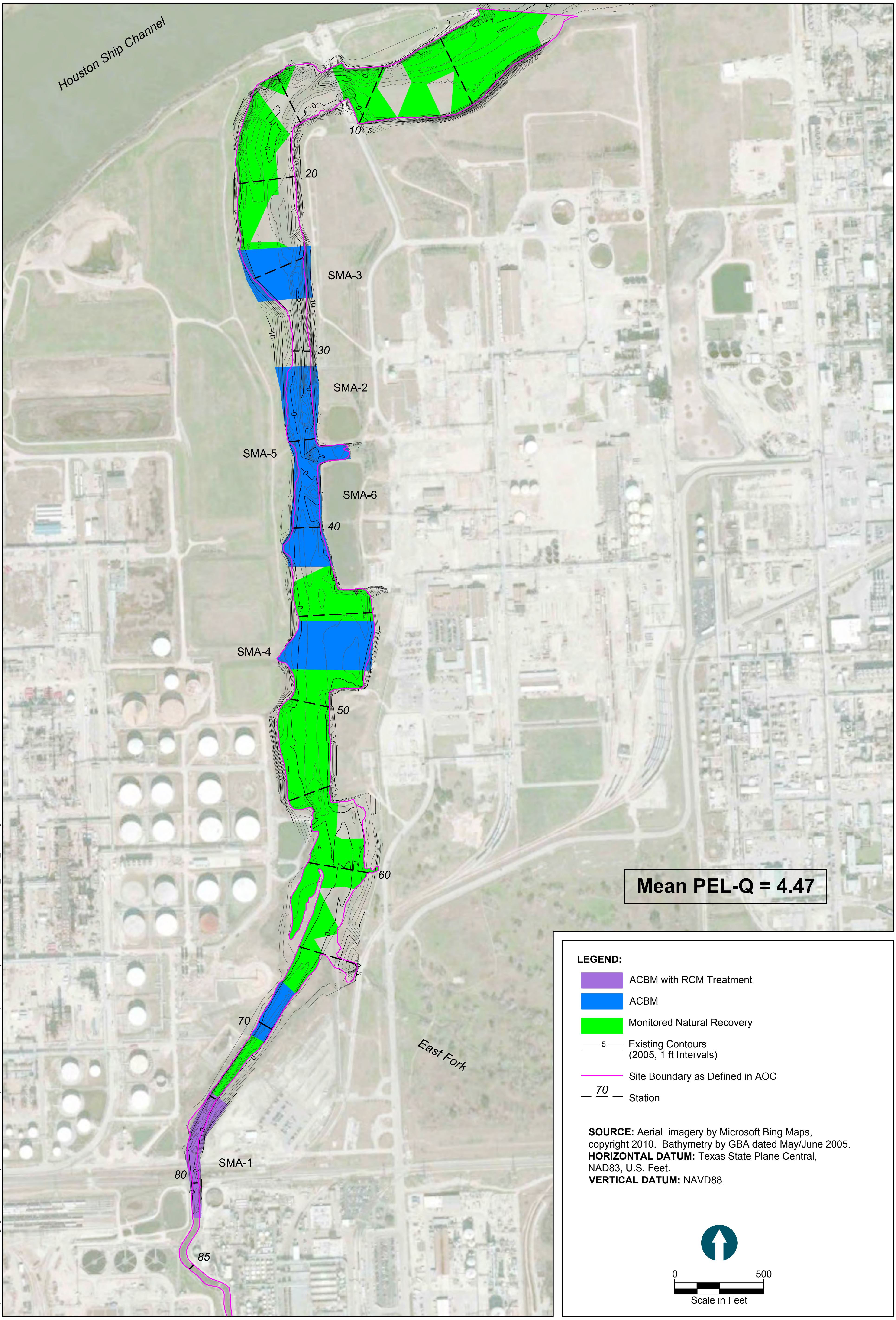

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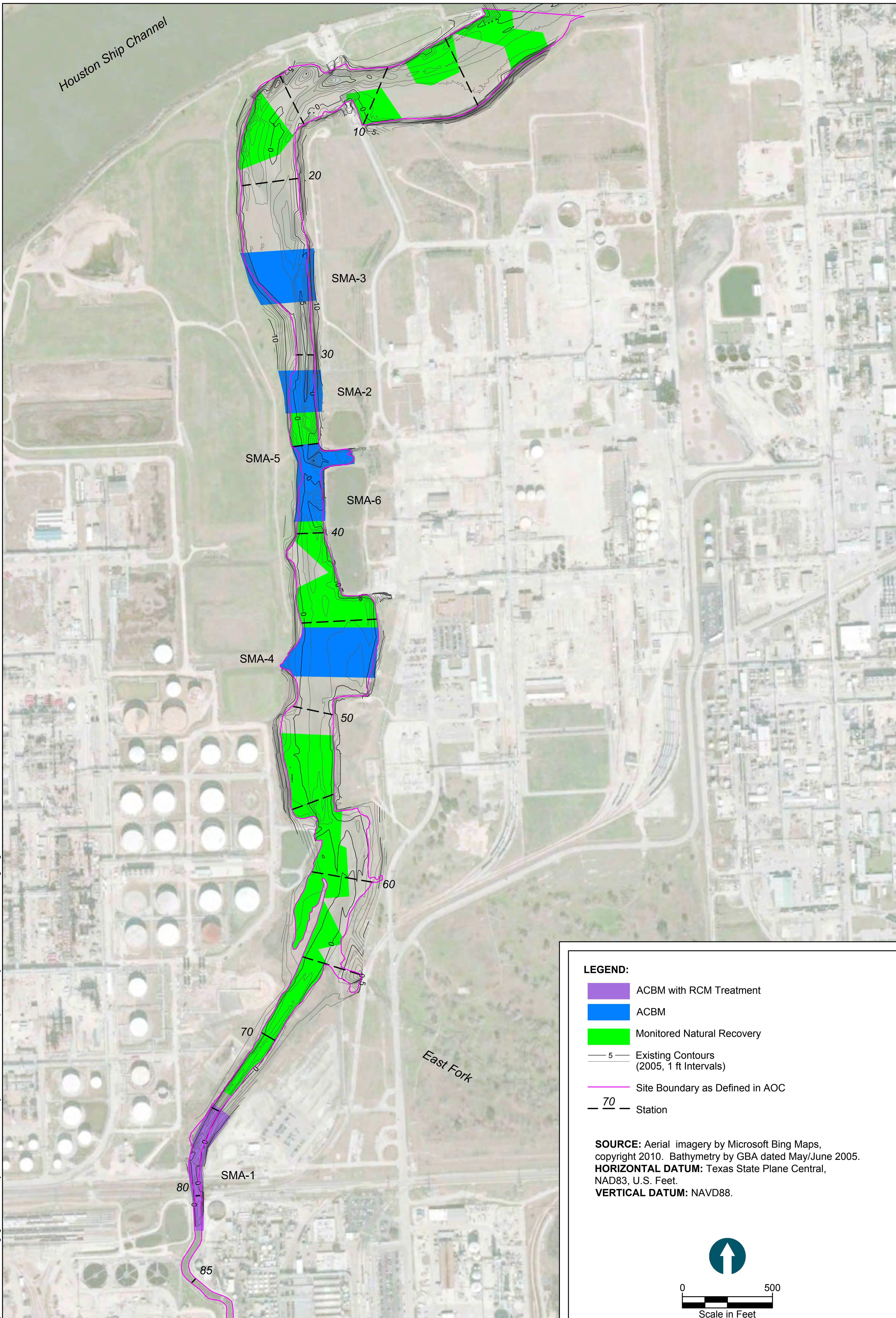
Exhibit 8

Plan View Alternative 4: Monitored Natural Recovery Zones and ACBM

Response to July 8, 2015 Comments

Patrick Bayou Superfund Site



Sep 23, 2014 11:45am tgriga K:\Projects\0284-Patrick Bayou Joint Defense Group\Patrick Bayou 2013\0284-RP-008.dwg Figure 4-6

Figure 4-6
Plan View Alternative 4: Monitored Natural Recovery Zones and ACBM
Patrick Bayou Feasibility Study Report
Patrick Bayou Superfund Site Remedial Investigation, Deer Park, Texas

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